Journal

of the

Royal Army Medical Corps

Journal

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Royal Army Medical Corps

EDITED BY

COLONEL SIR WILLIAM H. HORROCKS, K.C.M.G., C.B.

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MAJOR W. J. F. CRAIG, R.A.M.C.

VOL. LXXII.

January—June, 1939.

JOHN BALE, SONS & CURNOW, LTD.

83-91, GREAT TITCHFIELD STREET, OXFORD STREET, W.1.

No. 1. January, 1939. Vol. LXXII.

Journal OF Royal Army Medical Corps

ISSUED MONTHLY

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83-91, GREAT TITCHFIELD STREET, LONDON, W.1

Price Two Shillings and Sixpence net

VOL. LXXII. JANUARY, 1939. No. 1

Journal
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Original Communications.

THE BLOOD PICTURE IN SINGAPORE.

BY MAJOR A. J. BEVERIDGE, O.B.E., M.C., M.Sc.,
Royal Army Medical Corps.

THE interpretation of a blood picture should no longer be a rare art, but rather a routine procedure familiar to all physicians.

These notes are in no sense intended to replace the well-known manuals on the subject, but rather to supplement them as a result of local investigations. The importance of the blood picture has materially increased so as to take rank with the fundamental bedside examinations with records of the pulse rates, fever curves and urine tests. It must become a necessary part of a *secundum artem* medical examination in all doubtful or difficult cases. It has frequently been suggested that alterations in the blood-count and deviation from the recognized standards are climatic, and in consequence an investigation was undertaken in the winter of 1937-38, in Singapore, over a period of six months from October to March. The object of the study was:—

(1) To assess the normal values of the red and white cell blood-counts for European adults living in the tropics.

(2) To observe the changes in the hæmoglobin content of the blood, and the type of cell produced by length of time in the tropics.

It has been observed by several writers that the standards set out for the blood picture of a young adult vary to a great extent. This variation is probably more marked in the differential count than in any other

examination. Medical officers use the clinical picture so frequently for their diagnosis that it was felt that a local standard of the blood picture should be worked out.

The subjects of the observations were all young soldiers newly arrived in the tropics, some of whom had had a brief tour in tropical climates, but most had not served abroad before. They were twelve R.A.M.C. men who arrived to join No. 32 Company, R.A.M.C., in Singapore in October, 1937; all were between the ages of 20 and 30 years. They were examined monthly and all the examinations were carried out under the same conditions as follows:—

(1) Time: All examinations were carried out between 9 a.m. and 9.30 a.m.

(2) The volunteers were fasting and had not been subjected to any exercise.

(3) The examinations were carried out in the upright posture.

(4) The observers were the same throughout.

(5) The blood was capillary blood obtained from the finger by needle-prick.

(6) The total cell counts were made with pipettes and counting chambers of a standard type, and the usual technical precautions were taken to ensure accuracy. In order to reduce the factor of error to the minimum, in each case the mixing of the diluted sample of the red and white cell mixture was done by shaking by the hand for three minutes by the clock, so giving a uniform mixture. No mechanical rotor was available.

The blood slides for differential counts were stained with Giemsa. They were examined by a Beck microscope with one-twelfth oil emersion lens with a ×10 telaugic compensatory eyepiece.

Two observers carried out the examinations so as to eliminate the personal error as far as possible, and the results given are the mean of these observers' results.

In counting the white cells for the differential count care was taken to count backwards and forwards completely across the slide to avoid obtaining an undue number of small lymphocytes which are liable to be more numerous in the central portion of the smear than at the borders—a minimum of 800 cells was counted in each count and very often this total number was exceeded.

As regards the type of cells it will be seen that the *lymphocytes* have all been classified under one head, and that the differentiation into small and large lymphocytes has been abandoned.

The same procedure has been applied to the large mononuclears and the transitional cells—these cells all appear under the one heading, of mononuclears. Damaged cells and dying neutrophilic leucocytes have been disregarded in the counting of these cells.

One of the reasons leading up to the investigation is the variety of standards adopted by physicians, dependent on the school where they have received their education.

The variation of the textbook counts can be seen in some of the following figures:—

	Mean Average	Extreme Ranges
R.B.C.	5·4 m.	4·0 to 6·4 m. per c.mm.
W.B.C.	7,500	6,000 to 9,000 per. cmm.
Hb.	105·4 per cent	85·0 to 117·0 per cent
C.I.	0·98	0·84 to 1·11
Polymorphs	68·0 per cent	50·0 to 75·0 per cent
Eosinophils	2·6 ,, ,,	0 tc 3·6 ,, ,,
Basophils	0·5 ,, ,,	0 to 1·0 ,, ,,
Lymphocytes	24·2 ,, ,,	15·0 to 45·0 ,, ,,
Monocytes	4·8 ,, ,,	0·2 to 15·0 ,, ,,

In the making of blood-counts, and in clinical practice, it is common experience that occasionally blood-counts are made which are quite out of alignment with the average of the normal blood and the blood in disease. There are various explanations for these counts which it is not proposed to discuss here.

Although the literature dealing with the variations in the leucocyte count is replete with contradictions concerning the causes, conditions and extent of variations, yet it is noteworthy that the limits within which practically all these variations are observed, are relatively fixed.

It is well established that excessive physiological activity, as well as disease, may alter the leucocyte count beyond the normal limits, so that there is often a gradation between normal and diseased states, and it becomes difficult, in fact impossible in many cases, to draw a clear-cut line which delimits the normal from the abnormal states.

Discussion.

The white blood-cells of normal persons have been the subject of many and varied forms of investigation since they were first discovered in 1771 by Hewson. As a consequence, limits of the normal have been established for the total numbers per cubic millimetre of circulatory blood and for the percentage of the types of cells comprising this total.

These normal limits have been determined from observations made once on each group of healthy persons, or from data made by repeated observations of the same person's blood over a period of hours.

It is a generally accepted opinion that there can be a very great range in an individual and that there is no constant level for each type of cell.

Many observers have made extensive and elaborate studies, but few have counted the blood of the same individual more than two or three times a day.

These studies have, however, established the average number of various types of all white blood-cells and have given a mean level from which to estimate any abnormal level.

It is, of course, known that fluctuations will occur in the same individual during any one period of twenty-four hours to the extent of 100 per cent for the white blood-cells, but Turk [1] considers that the white cell count is at its minimum in the early morning when a person is at complete rest and before the ingestion of food.

The influence of various physiological processes on the white blood-cell picture has also been studied extensively. However, comparatively little information is available concerning the fluctuations of the nucleated blood-cells that may occur over an extended period of time in a normal person.

The great clinical significance of leucocytosis has made the study of the mechanism of the increase and decrease of the white blood-cells one of the greatest importance, and many observations have been reported in regard to the mechanism by which the number of these cells is increased or decreased.

There is a rhythm for the white blood-cells just as there is a rhythm for the temperature. This rhythm is applicable both to the total count and to the individual type of cell. This rhythm has the effect in an individual count of varying it in the proportion of 1 to 2.

Posture does alter the white blood-count to a certain degree, but is not sufficient to render the count of pathological significance. A person in the recumbent position will always give a total white blood-count higher than one in the erect position (E. Jacobsen [2]).

There will always be a mathematical error in the number of cells counted, and any two observers working with separate counting chambers on the same blood specimen will show an error up to 30 per cent. This is referred to in many papers on the subject as the " fortuitous error."

Some counts will fall near the lower limit and some near the upper limit of a normal physiological range. The significance of any single count can be judged only according to the frequency with which counts of this magnitude occur in a population of normal individuals.

The enormous literature on leucocyte counts indicates clearly that as the leucocyte count increases above 10,000 cells per c.mm. of blood, the chances of its occurrence in a normal individual decrease rapidly, and for this reason this arbitrary figure has been set, quite universally, as deciding the upper limit of variation in normal adults.

As regards the ages of the individuals of the present investigation, it is of interest that Osgood [7] reported in 1934 to the American Medical Association that the mean total for this age-group (20 to 30 years) was 7,400 leucocytes, and that limits were 4,500 to 11,000 white cells.

That large and quite abrupt oscillations in the leucocyte count sometimes occur in normal individuals has been the experience of many observers, and frequently this phenomenon is not due to any evident excitement.

In this investigation all the observations were made at a uniform time (9 a.m.) and on fasting individuals who had been resting, but in the upright posture as far as was practicable, in fact the state might be referred to as basal.

Stetson [3] showed that even under these ideal conditions an individual would show a variation of 30 per cent from day to day.

W. E. Garrey and Ray Bryan [4] note that they found no clear-cut evidence that there is any climatic difference or seasonal variation in the leucocytes.

Exposure to the sun's rays induces an increase of the lymphocytes—this can account for the increase in the lymphocytes observed by Taylor [5] in twenty-five out of thirty-eight persons examined by him after they had spent a summer at Woods Hole, Mass. He also found that the more pigmented the skin was from solar rays, the greater tendency there was for the lymphocytic increase, though this was not invariably the case. This phenomenon has also been noted amongst X-ray workers. Observations on subjects in the Philippines showed a progressive monocyte increase in the blood of soldiers stationed there over periods of three, twelve, and nineteen months after their arrival.

Thus the effect of sunlight may be a seasonal factor in influencing the differential white cell count, but the temperature and sunlight in Singapore vary so little that it is doubtful if they are responsible for the fluctuations which have occurred in these observations. It is, however, a fact that heat will produce a leucocytosis, and that a combination of heat and solar radiation will produce a lymphocytosis.

It will be noted that the totals vary from those of Stetson [3] who found his normal count for polymorphs was 51·04 per cent, and for lymphocytes 36·04 per cent on a constant examination of six normal persons.

Discussion regarding the classification of the various cells is purposely omitted as this has already been so well defined in recent years by eminent writers on the subject.

In healthy individuals the leucocyte count is at its lowest, sometimes below 5,000 in the early morning, when the person is at rest and before food is ingested. The main diminution is in polymorphonuclears. The count gradually rises during the day and reaches its maximum in the afternoon.

In examining the various charts a great variation of the white cell count will be seen, not only over the group presented, but also in the chart of the individuals.

Kennedy [6] carried out examinations on 400 healthy adults in Iraq, the majority of whom were British airmen; his figures are of interest as many of his observations had the same object as the present investigation. A comparative table of the figures shows:—

	Kennedy	This Investigation
R.B.C.	5·375 m.	5·512 m.
W.B.C.	8,780	7,551
Hb.	96·3 per cent	89·37 per cent
Hb. (grammes) ..	—	15·135
Differential		
Polymorphonuclears ..	57·10 per cent	56·876 per cent
Lymphocytes	26·07 ,, ,,	37·676 ,, ,,
Eosinophiles	3·63 ,, ,,	1·963 ,, ,,
Mononuclears.. ..	13·08 ,, ,,	3·164 ,, ,,
Basophiles	—	0·334 ,, ,,

It will be noted in referring to the mean averages that the following points are worthy of attention: Red blood-cells and white blood-cells are very much in keeping with the mean averages; the hæmoglobin percentage is much below both the mean average and that of Kennedy; our hæmoglobin estimation was carried out by the Gower hæmoglobinometer and the gramme correction worked out later.

In the individual examinations this loss of hæmoglobin is not a progressive condition, for while the average is below the mean—six showed a diminution, three a gradual rise, and three remained constant during the period under review—at the same time the low hæmoglobin content would account for the pale appearance in many Europeans—so very marked in European children during their residence in Singapore. This appearance quickly disappears on their return to temperate climates.

In the differential count totals the total of polymorphonuclears is more in keeping with Kennedy's average than the mean. The lymphocytes are above both Kennedy's counts and the mean totals by nearly 10 per cent. This lymphocyte increase occurred in a group of individuals who presented a high count at the start of the period when the average count was 36·5 per cent—five showed a progressive increase and five showed a progressive decrease, two remained constant. Eosinophiles are below both those of Kennedy and the mean.

Mononuclears are more in keeping with the mean average than Kennedy's figure.

It will be seen that the mean percentage of the different cells does not add up to exactly 100. This is due to the method of grouping the data—the error is negligible as it is the general percentage to two places of decimals which is desired. The figures are the result of our final calculation of the mean of all the individual examinations.

Individual Examinations.

CPL. THOMAS R.A.M.C.

	R.B.C. (Millions)	W.B.C.	Haemoglobin (Gower) Per cent	Grams	Differential W.B.C. (Total of 800): Polymorph	Lymphocytes	Eosinophils	Basophils	Mononuclears
8.10.37	4·79	7,650	76%	13·2	53·435%	39·4%	2·995%	1·22%	3·05%
4.11.37	4·86	10,540	82%	14·0	54·775%	41·0%	1·675%	NIL	2·55%
3.12.37	5·295	10,280	84%	14·3	51·425%	43·775%	2·85%	0·225%	1·725%
5.1.38	5·82	14,970	78%	13·5	58·25%	35·875%	1·25%	0·50%	4·125%
27.1.38	4·375	10,050	93%	15·5	65·375%	29·0%	2·5%	0·125%	3·0%
23.2.38	4·995	11,200	86%	14·6	61·0%	30·75%	2·875%	0·125%	5·25%
MEAN =	5·039	10,781	83·1%	14·18	57·373%	36·633%	2·357%	0·365%	3·283%

PTE BEAK R.A.M.C.

	R.B.C. (Millions)	W.B.C.	Haemoglobin (Gower) Per cent	Grams	Differential W.B.C. (Total of 800): Polymorph	Lymphocytes	Eosinophils	Basophils	Mononuclears
4.10.37	5·03	10,600	100%	16·5	70·6%	25·7%	1·9%	0·3%	1·5%
12.11.37	5·345	7,393	90%	15·1	57·625%	36·0%	2·0%	0·625%	3·75%
9.12.37	5·26	6,500	90%	15·1	68·5%	28·0%	1·75%	0·375%	1·375%
5.1.38	6·8	11,325	100%	16·5	61·225%	33·6%	1·025%	0·1%	4·05%
3.2.38	5·545	7,320	94%	15·7	56·125%	38·875%	2·125%	NIL	2·875%
3.3.38	5·66	8,749	80%	13·8	51·875%	42·5%	1·0%	0·125%	4·5%
MEAN =	5·606	8,647	92·3%	15·45	60·991%	34·112%	1·633%	0·254%	3·008%

PTE DAFFERN R.A.M.C.

	R.B.C. (Millions)	W.B.C.	Haemoglobin (Gower) Per cent	Grams	Differential W.B.C. (Total of 800): Polymorph	Lymphocytes	Eosinophils	Basophils	Mononuclears
4.10.37	4·85	12,250	84%	14·3	55·125%	41·35%	0·75%	0·4%	2·375%
12.11.37	5·01	12,256	88%	14·9	53·44%	45·065%	0·695%	0·34%	1·52%
16.12.37	4·88	8,062	87%	14·7	54·5%	43·5%	0·625%	0·125%	1·25%
6.1.38	4·963	9,025	84%	14·3	39·875%	53·75%	1·125%	NIL	5·25%
3.2.38	5·12	11,170	84%	14·3	40·0%	56·75%	0·75%	0·375%	2·125%
3.3.38	4·8	7,187	80%	13·8	43·125%	54·125%	1·0%	0·125%	1·625%
MEAN =	4·937%	9,961	84·5%	14·383	47·51%	49·09%	0·824%	0·227%	2·356%

PTE CRUICKSHANKS R.A.M.C.

	R.B.C. (Millions)	W.B.C.	Haemoglobin (Gower) Per cent	Grams	Differential W.B.C. (Total of 800): Polymorph	Lymphocytes	Eosinophils	Basophils	Mononuclears
4.10.37	6·05	7,500	96%	16·0	46·75%	48·625%	1·75%	NIL	3·0%
12.11.37	5·41	9,600	90%	15·1	58·625%	36·625%	1·625%	0·25%	2·875%
9.12.37	5·88	8,500	86%	14·6	73·5%	24·05%	1·4%	0·125%	0·925%
6.1.38	5·87	12,375	96%	16·0	56·4%	39·3%	1·95%	NIL	2·35%
3.2.38	5·61	9,110	85%	14·4	63·29%	33·38%	1·43%	0·36%	1·54%
3.3.38	4·54	12,187	84%	14·3	58·375%	38·375%	0·5%	0·125%	2·625%
MEAN =	5·56	9,877	89·5%	15·066	59·490%	36·725%	1·442%	0·143%	2·219%

PTE FULLICK R.A.M.C.

	R.B.C. (MILLIONS)	W.B.C	HAEMOGLOBIN		POLYMORPH	LYMPHOCYTES	EOSINOPHILS	BASOPHILS	MONONUCLEARS
					DIFFERENTIAL W.B.C.				
28 10 37	5·857	11,125	90%	15·1	50·275%	45·625%	0·5%	0·25%	3·355%
29 11 37	5·23	7,650	—	—	53·75%	42·5%	1·5%		2·25%
22 12 37	5·81	7,337	95%	15·8	59·75%	34·55%	2·825%	0·875%	2·0%
20 1 38	6·585	11,500	98%	16·2	66·125%	29·875%	1·375%	0·25%	2·375%
24 2 38	5·565	8,293	86%	14·6	60·125%	34·625%	1·25%	0·5%	3·5%
17 3 38	5·23	7,757	90%	15·1	64·675%	28·75%	3·0%	0·25%	3·325%
MEAN =	5·637	8,945	91·8%	15·8	59·111%	35·987%	1·74%	0·425%	2·967%

PTE KNIGHT R.A.M.C.

	R.B.C. (MILLIONS)	W.B.C	HAEMOGLOBIN (GOWER)		POLYMORPH	LYMPHOCYTES	EOSINOPHILS	BASOPHILS	MONONUCLEARS
					DIFFERENTIAL W.B.C				
21 10 37	5·048	5,600	98%	16·2	60·375%	34·0%	1·75%	1·0%	2·875%
18 11 37	5·14	5,370	84%	14·3	52·75%	43·25%	0·75%	0·375%	2·875%
16 12 37	6·24	3,818	90%	15·1	50·375%	45·415%	1·255%	0·455%	2·5%
13 1 38	6·32	5,631	100%	16·0	55·625%	39·75%	1·125%	0·625%	2·875%
24 2 38	4·521	6,156	88%	14·9	55·5%	37·0%	2·875%	0·375%	4·25%
17 3 38	4·875	5,781	80%	13·8	59·75%	33·825%	2·0%	0·75%	3·675%
MEAN =	5·357	5,392	90%	15·05	55·736%	38·873%	1·625%	0·596%	3·17%

PTE KENDALL R.A.M.C.

	R.B.C. (MILLIONS)	W.B.C.	HAEMOGLOBIN (GOWER)		POLYMORPH	LYMPHOCYTES	EOSINOPHILS	BASOPHILS	MONONUCLEARS
					DIFFERENTIAL W.B.C.				
28 10 37	6·245	10,125	104%	17·1	68·925%	25·625%	1·375%	0·2%	3·875%
25 11 37	5·80	9,060	—	—	59·725%	33·35%	2·65%	0·3%	3·975%
22 12 37	6·80	5,650	92%	15·4	61·75%	32·0%	0·75%	0·625%	4·875%
20 1 38	7·5	13,400	90%	15·6	72·7%	21·675%	1·5%	0·375%	3·75%
17 2 38	6·105	8,300	96%	16·0	63·625%	31·25%	1·625%	0·25%	3·25%
10 3 38	4·96	8,124	85%	14·4	60·75%	29·625%	1·5%	0·625%	7·5%
MEAN =	6·245	9,443	93·4%	15·7	64·579%	28·905%	1·564%	0·395%	4·557%

PTE KELLAND R.A.M.C.

	R.B.C. (MILLIONS)	W.B.C.	HAEMOGLOBIN		POLYMORPH	LYMPHOCYTES	EOSINOPHILS	BASOPHILS	MONONUCLEARS
					DIFFERENTIAL W.B.C.				
21 10 37	5·045	8,900	90%	15·1	67·438%	25·062%	2·625%	NIL	4·875%
18 11 37	4·695	4,590	82%	14·0	52·75%	40·625%	2·75%	0·25%	3·625%
16 12 37	5·325	4,775	87%	14·7	63·25%	33·975%	0·855%	0·1%	1·925%
13 1 38	6·92	5,355	94%	15·7	67·625%	28·625%	1·625%	0·125%	2·0%
10 2 38	5·105	10,720	90%	15·1	77·5%	18·875%	1·0%	0·125%	2·5%
10 3 38	5·695	6,562	90%	15·1	66·5%	25·375%	2·5%	NIL	5·625%
MEAN =	5·464	6,817	88·63%	14·95	65·834%	28·756%	1·892%	0·100%	3·425%

PTE PORTHOUSE R.A.M.C.

DIFFERENTIAL W.B.C. (TOTAL OF 800)

	R.B.C. (MILLIONS)	W.B.C.	HAEMOGLOBIN (COWLER) PERCENT	GRAMS	POLYMORPH	LYMPHOCYTES	EOSINOPHILS	BASOPHILS	MONONUCLEARS
8 10 37	5·37	4,480	88%	14·9	51·695%	43·55%	1·665%	0·55%	2·32%
4 11 37	6·256	4,910	86%	14·6	47·875%	47·625%	2·70%	0·175%	1·625%
2 12 37	5·53	3,434	86%	14·6	60·0%	35·75%	1·625%	0·5%	2·125%
6 1 38	6·075	6,100	90%	15·1	58·325%	34·0%	3·5%	0·5%	3·675%
27 1 38	5·965	5,470	90%	15·1	57·25%	36·375%	2·125%	0·5%	3·75%
24 2 38	5·995	4,200	88%	14·9	48·875%	45·0%	1·25%	0·75%	4·125%
MEAN =	5·848	4,765	88%	15·53	54·033%	40·33%	2·127%	0·625%	2·937%

PTE SPENCER R.A.M.C.

DIFFERENTIAL W.B.C.

	R.B.C. (MILLIONS)	W.B.C.	HAEMOGLOBIN (COWLER) PERCENT	GRAMS	POLYMORPH	LYMPHOCYTES	EOSINOPHILS	BASOPHILS	MONONUCLEARS
21 10 37	5·49	5,550	76%	13·5	65·5%	27·187%	2·5%	0·063%	2·0%
18 11 37	4·78	5,870	94%	15·7	31·625%	64·5%	1·876%	0·5%	1·5%
16 12 37	4·8	4,078	86%	14·6	54·375%	38·375%	3·75%	0·5%	3·0%
13 1 38	6·49	6,070	92%	15·4	44·125%	47·0%	2·0%	0·125%	6·75%
10 2 38	3·64	4,400	80%	13·8	43·625%	51·375%	1·125%	0·375%	3·5%
10 3 38	5·18	4,218	90%	15·1	57·25%	37·5%	2·125%	0·375%	2·75%
MEAN =	5·06	5,031	86·6%	14·6	49·087%	44·323%	3·062%	0·323%	3·25%

PTE TURNER R.A.M.C.

DIFFERENTIAL W.B.C.

	R.B.C. (MILLIONS)	W.B.C.	HAEMOGLOBIN (COWLER) PERCENT	GRAMS	POLYMORPH	LYMPHOCYTES	EOSINOPHILS	BASOPHILS	MONONUCLEARS
28 [illegible] 37	5·8	6,275	96%	16·0	49·375%	45·5%	2·125%	0·25%	2·75%
25 [illegible] 37	5·51	4,630	—	—	48·7%	46·8%	1·55%	0·6%	2·35%
22 [illegible] 37	6·185	6,862	96%	16·0	56·25%	38·75%	2·625%	0·375%	2·0%
20 [illegible] 38	7·01	5,700	100%	16·5	54·375%	37·25%	5·25%	0·375%	2·75%
[illegible] 2 38	4·425	5,800	90%	15·1	47·525%	45·4%	4·08%	0·33%	2·675%
17 3 38	5·53	6,249	85%	14·4	59·0%	33·125%	2·75%	0·125%	5·0%
MEAN =	5·74	5,919	93·4%	15·6	52·537%	41·137%	3·063%	0·34%	2·92%

PTE. WARD. R.A.M.C.

DIFFERENTIAL W.B.C. (TOTAL OF 800)

	R.B.C. (MILLIONS)	W.B.C.	HAEMOGLOBIN (COWLER) PERCENT	GRAMS	POLYMORPH	LYMPHOCYTES	EOSINOPHILS	BASOPHILS	MONONUCLEARS
8 10 37	4·75	7,950	89%	15·0	54·875%	40·5%	1·375%	NIL	3·25%
4 11 37	6·325	6,600	96%	16·0	53·075%	42·625%	1·325%	0·2%	2·775%
2 12 37	5·15	7,360	92%	15·4	63·95%	30·985%	1·925%	0·445%	2·695%
5 1 38	5·70	6,137	86%	14·6	54·875%	38·375%	2·125%	0·5%	4·125%
27 1 38	6·375	8,560	94%	15·7	62·125%	30·375%	3·375%	0·125%	4·0%
3 3 38	5·605	5,624	90%	15·1	48·625%	40·625%	3·25%	0·375%	7·125%
MEAN =	5·65	7,038	91·1%	15·3	56·254%	37·247%	2·228%	0·274%	3·996%

SUMMARY OF THE MEAN OF INDIVIDUAL EXAMINATIONS.

	R.B.C. (MILLIONS)	W.B.C.	HAEMOGLOBIN (GOWERS)		DIFFERENTIAL W.B.C. (TOTAL OF 800)				
			PERCENT	GRAMMS	POLYMORPHS	LYMPHOCYTES	EOSINOPHILS	BASOPHILS	MONONUCLEARS
CPL. THOMAS.	5·039	10,781	83·1%	14·18	57·373%	36·633%	2·375%	0·365%	3·283%
PTE. BEAK.	5·606	8,647	92·3%	15·45	60·991%	34·112%	1·633%	0·254%	3·008%
PTE. DAFFERN.	4·937	9,961	84·5%	14·383	47·51%	49·09%	0·824%	0·227%	2·356%
PTE. CRUICKSHANK.	5·560	9,877	89·5%	15·066	59·490%	36·725%	1·442%	0·143%	2·219%
PTE. FULLICK.	5·637	8,945	91·8%	15·8	59·111%	35·987%	1·740%	0·425%	2·967%
PTE. KNIGHT.	5·357	5,392	90%	15·05	55·736%	38·873%	1·625%	0·596%	3·170%
PTE. KENDALL.	6·425	9,443	93·4%	15·7	64·579%	28·905%	1·564%	0·395%	4·557%
PTE. KELLAND.	5·464	6,817	88·83%	14·95	65·834%	28·756%	1·892%	0·100%	3·425%
PTE. PORTHOUSE.	5·848	4,765	88%	15·53	54·033%	40·33%	2·127%	0·625%	2·937%
PTE. SPENCER.	5·060	5,031	86·6%	14·6	49·087%	44·323%	3·062%	0·323%	3·250%
PTE. TURNER.	5·740	5,919	93·4%	15·6	52·537%	41·137%	3·063%	0·340%	2·920%
PTE. WARD.	5·650	7,038	91·1%	15·3	56·254%	37·247%	2·228%	0·274%	3·996%
MEAN OF ALL EXAMINATIONS AND SUGGESTED STANDARDS →	5·512	7,551	89·37%	15·135	56·876%	37·676%	1·963%	0·339%	3·164%

Conclusions.

(1) The records of observations on twelve healthy R.A.M.C. men in the third decade of life, living hygienically and working under normal conditions for their sphere of military life are given.

(2) The study was undertaken to set out a standard as a guide to the clinician to which he could refer his report on blood examinations.

(3) The series of six counts on each individual at approximately four weeks' interval are given, and it is agreed that while the number of data available is small to allow for a deduction it is sufficient to draw up a standard.

(4) It will be seen that though the standards are suggested they can only be reached by taking the mean, not only of an individual, but the mean of several counts over a long period, and also the number of cells counted in each count must necessarily be very large; in our counts we have counted a minimum of 800 cells in each observation.

(5) The percentage of hæmoglobin is 16 per cent below the mean average, but this is not a constant loss in the individuals. This may be due to climate, but observations over a longer period would be necessary to prove it.

(6) There appears to be an increase in lymphocyte cells—also not constant.

I have to acknowledge my gratitude to my laboratory assistants, Corporals O'Donnell and Cooper, for their assistance, and to Professor Scott McGregor of King Edward VII College of Medicine, Singapore, for his guidance and valuable suggestions in carrying out the observations, and lastly to those volunteers whose records are given here.

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NOTES ON A CASE OF INFANTILE LEISHMANIASIS IN TRANSJORDAN.

By Major J. T. ROBINSON, M.A., M.D., B.Ch., D.T.M. & H.,
Royal Army Medical Corps.

Senior Medical Officer, Transjordan Frontier Force.

Introduction.

The country of Transjordan (Map 1) lies adjacent to Palestine on the west. It is separated from it only by the river Jordan. The north of Transjordan is bounded by Syria and the Lebanon; the north-east by Iraq, while the eastern and southern boundaries are formed by Saudi Arabia.

The climate of Transjordan is similar to that existing in Palestine. The ruling feature of the climate is the division of the year into rainy and dry seasons. The former begins in November and ends in April. During these months snow and bitter cold may be experienced in the hills. The warm weather begins in April, the hottest months being July and August when temperatures of 104° F. in the shade are not unusual.

The case to be described came from the village Zerka. This has a native population of about 5,000 and lies some 3,000 feet above sea level—being about 60 miles north-east of the Jordan Valley.

It has long been recognized that endemic kala-azar occurs in many of the islands and countries of the Mediterranean basin. The disease is practically confined to young children. Infection occurs chiefly through the Phlebotomus especially *P. major* and *P. major* var. *Syriacus*, and has been clearly shown by Adler and others to be associated with the disease in dogs [1].

In the Lebanon, infantile leishmaniasis has been recognized for some years but is comparatively rare. Cutaneous leishmaniasis is very common in the Lebanon, Syria and Iraq.

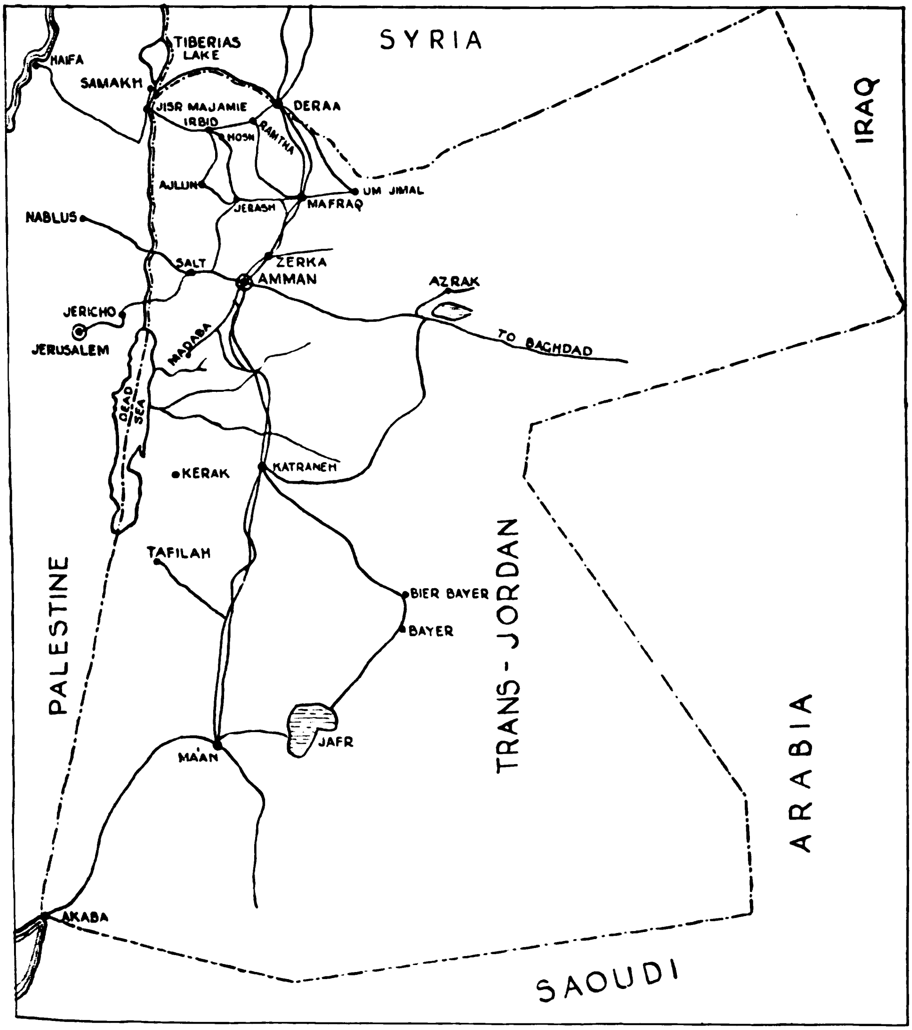
In Palestine endemic cases of oriental sore are widespread and the disease has existed for many years—being particularly prevalent in the Jordan Valley. During the last two years troops of the Transjordan Frontier Force have been on active service in Jericho, and about 10 per cent were infected with cutaneous lesions.

Adler could not establish the disease in dogs in Transjordan.

It was not until 1930 that the first case of infantile leishmaniasis was reported in Palestine by Ostrowski [2]. Since then some fourteen cases have been reported by Cana'an [3] and others. In none of the cases could signs of existing or cured dermal lesions be found. None of the relatives in contact with the cases had suffered from dermal infection

with *Leishmania tropicum,* nor could evidence of fresh or healed sores be found upon them.

A study of the annual reports of the Department of Health, Transjordan Government, for the years 1928 to 1937, has established the



MAP 1.—Transjordan, showing adjacent boundaries.

existence of endemic cutaneous leishmaniasis in Transjordan. The origin of these cases has not been reported but the majority are believed to have been infected in the Jordan Valley.

Every year labourers from all over Transjordan spend some time working in this area and a few weeks after their return report with

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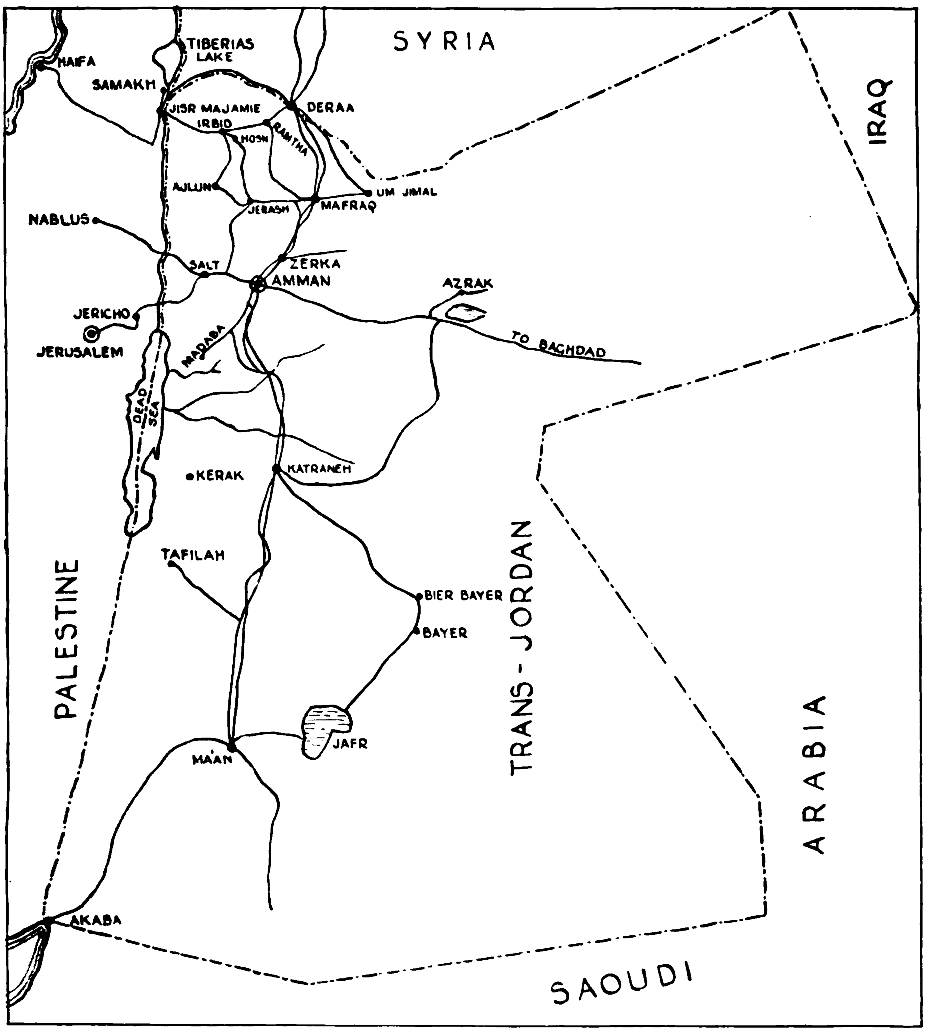

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existence of endemic cutaneous leishmaniasis in Transjordan. The origin of these cases has not been reported but the majority are believed to have been infected in the Jordan Valley.

Every year labourers from all over Transjordan spend some time working in this area and a few weeks after their return report with

cutaneous infection. They frequently state that they were bitten by insects in the Jordan Valley; that they scratched these places and the sores developed.

It is therefore considered that the case to be described is worthy of record, being the first to be reported in Transjordan. It is hoped that further cases may be sought in this country and facts discovered which may enhance our present knowledge of the epidemiology and ætiology of this grave disease. This case brings the total number reported in Palestine and Transjordan up to sixteen.

THE CASE.

(*a*) *History*.—On June 16, 1938, the patient, a male child aged 2 years, living in Zerka village, was brought to the Transjordan Frontier Force hospital with fever and swollen abdomen. The son of a Chichan—he had never left the vicinity of the village before he became ill.

He had never been ill until two and a half months ago (April) when his mother observed that he had fever and diarrhœa. The mother attributed the fever to the diarrhœa and gave the child castor oil, which she stated stopped the diarrhœa and made the fever a little better for a few days. The child, however, was fretful and the fever without diarrhœa continued. The parents also noticed the child's abdomen was bigger than normal. Accordingly, early in May, he was seen by several doctors and attended the out-patient clinic of a hospital where he was given some medicine. Attempts to obtain clinical notes from the hospital revealed no record of the case. The parents stated emphatically that the doctors thought the child had malaria. The parents also stated he ate and slept well.

(*b*) *Family History*.—The father and mother, both Chichan, were born in Zerka village and have always lived there. They have never left Transjordan. The mother stated she had malaria some years ago. The father and an only sister aged 4½ years had never been ill. All were clinically examined and revealed no evidence of disease.

(*c*) *Clinical Notes*.—The child was a fair-haired boy with pasty face and pale lips but otherwise normally developed. The hair was of fine texture but luxuriant and showed no tendency to fall out. No rashes or suspicious sores were found on any part of the body, nor was any icterus observed. The mucous membranes were pale but there was no epistaxis or bleeding from the gums, nor were any gangrenous changes found in the mouth or other parts of the body. The tongue was clean and the eyes showed no inflammation or other abnormality. Both tonsils were enlarged and infected with the common pathogenic organisms of the throat. No *L. donovani* bodies were found in swabs. Otorrhœa was present in both ears; the mother stated this started eight days previous to reporting

at the Transjordan Frontier Force hospital. The cervical glands were enlarged, smooth, easily palpable and rolled separately between the fingers. No organic disease was observed in the heart or lungs.

The superficial abdominal veins were tortuous and distended. The spleen, much enlarged, extended almost to the left iliac crest and filled the greater part of the left side of the abdomen. A marked feature was the smooth and firm consistency of the enlargement. The liver was also much enlarged.

No abnormality was observed in the nervous system. Splenic puncture was performed and smears stained with Leishman's stain. Numerous extra-cellular *L. donovani* bodies were found. Slides of spleen smears were sent to Dr. Stuart, Pathologist, Government Laboratory, Jerusalem, and to Dr. Blofield, Government Laboratory, Transjordan. Both confirmed the presence of these parasites.

In blood smears taken on several occasions no malaria parasites were found.

On the date of admission to hospital the total white cells amounted to 7,800 per c.mm., the red cells numbered 4,050,000 per c.mm., hæmoglobin 37 per cent (Sahle); while a differential count of the white cells showed a complete absence of eosinophils; neutrophile polymorphs numbered 48 per cent, lymphocytes 37 per cent, monocytes 13 per cent, and myelocytes 2 per cent. Anisocytosis and poikilocytosis were present, but no polychromasia was noticeable.

A specimen of fæces showed pale but well-formed stools; no ova or parasites could be detected. No abnormal constituents were found in the urine.

Neostibosan not being procurable for several days, the child was given intramuscular injections of fouadin. He was admitted to hospital, but after three days was removed by the parents. Treatment was therefore continued in the out-patient clinic with fouadin until June 27, when the neostibosan arrived.

Local treatment was applied to the throat and ears which cleared up in about four days. The child was also given syr. ferri. phos. co. in cod-liver oil and malt.

There appeared to be no clinical improvement at the end of treatment with fouadin. A blood examination was carried out prior to the first injection of neostibosan and the results obtained were as follows: leucocytes 7,968 per c.mm.; hæmoglobin (Sahle) 37 per cent; erythrocytes 4,500,000 per c.mm.; polymorphonuclear neutrophils 43 per cent; polymorphonuclear eosinophils 0 per cent; monocytes 18 per cent; myelocytes 2 per cent; anisocytosis —; poikilocytosis —.

Another spleen puncture was carried out and spleen pulp smears showed numerous *L. donovani* bodies still present.

Shillings' shift showed :—

	Myelocytes	Juvenile	Stabs	Segments	Lymphocytes	Monocytes
Normal %	0	0–1	3–5	58–66	21–30	4–8
Blood of patient	2	4	6	32	35	18

Intramuscular injections of neostibosan were commenced on the day these examinations were carried out and were continued every three days in doses as laid down by the producers (Bayer). The temperature fell after the second dose and the general condition improved rapidly.

A total of 3 g. of neostibosan was administered and treatment stopped on September 6. By this date temperature had been normal for a period of two weeks and the spleen was reduced to one quarter the original size. The mother was requested to bring the child twice monthly for observation.

Further Investigations.

The Director of Public Health, Transjordan Government, was interviewed and his co-operation obtained so that a spleen survey of the inhabitants in Zerka of all ages was undertaken with the aid of the M.O.H. All cases of splenomegaly and anæmia and/or diarrhœa were submitted to full clinical examination and all the bloods were examined for malaria.

Those with large spleens in whom no malaria parasites could be found after repeated blood examinations were subjected to splenic puncture. In no cases was *L. donovani* found.

A search was also made for suspicious sores and none was found.

A request to be allowed to examine all wasted and unhealthy dogs was granted. With the aid of the police, dogs were shot and brought immediately to the hospital and examined for seborrhœa and patches of depilation round the eyes and skin lesions. Several dogs appeared healthy, but these were fully examined since Adler and his co-workers [4] showed that infected animals may appear well nourished and in good health. Autopsies were performed and stained smears of bone-marrow, spleen and liver were examined.

The canine population in and around Zerka was very small due to the destruction of pariah dogs at the end of 1937 when there was a scare of rabies. The Moslem dislike for canine pets also contributed to the few dogs caught, so that it was only possible to examine twenty-one dogs. In none was there any evidence of leishmania infection.

The house of the patient was inspected and proved to be a mud-walled building consisting of one living room, a yard, and an outside kitchen.

The roof of the living room was made of wooden rafters and in it and other parts of the room numerous sand-flies were obtained.

The general sanitation was good and the house clean. The drinking water was obtained from a pump about four hundred yards away. No bugs or other insects were discovered in the house and inquiry failed to elicit their presence.

Sand-flies were collected from the house and vicinity and taken to Professor Adler for identification. The first batch was collected at sun-down over a period of several days and proved to be *Phlebotomus papatasii*. A second batch was obtained between the hours 9 to 10 p.m., and these were also identified as *P. papatasii*. No *P. major* were found. Daily catches were continued until August 31, and over 3,000 sand-flies from Zerka village were examined; 75 per cent of these were females and were identified according to Adler's method as *P. papatasii*.

There were no domestic animals nor any fowls in the vicinity of the house.

Comments.

The months of April, May, June and July are recognized as the "sand-fly" months during which individuals suffer from the characteristic fever. On a spleen survey it was noted that about 4 per cent of the children suffered from "Harara," a condition described by Theodor [5] in 1935 and attributed to Phlebotomus bites.

Many of the kala-azar cases in Palestine first reported with complications, and the majority were fatal.

Cana'an pointed out that adults may also fall victims to the disease. This is borne out by workers in the Lebanon who have seen several cases of adult kala-azar.

The distribution of visceral leishmaniasis in the Mediterranean suggested that the disease was either transmitted by a species of insect which was common and widely distributed but was not an efficient vector, or that it was transmitted by an efficient vector which was comparatively rare and irregularly distributed. The Phlebotomus was incriminated as the vector.

The behaviour of *L. infantum* in the sand-fly suggested that *P. papatasii* might be a carrier, for Adler and Theodor [6] showed that cultures from several strains of *L. infantum* when ingested by *P. papatasii* multiplied and adopted an anterior position. Experiments with cultures and direct feeding experiments on a mouse showed that an anterior position was only adopted when the resulting infection in the sand-fly was very heavy. It tended to show that *P. papatasii* could be infected in Nature only under favourable conditions, e.g. by feeding on a host with large numbers of parasites. In the absence of direct feeding experiments on humans, the authors concluded that *P. papatasii* may transmit the disease, but rarely.

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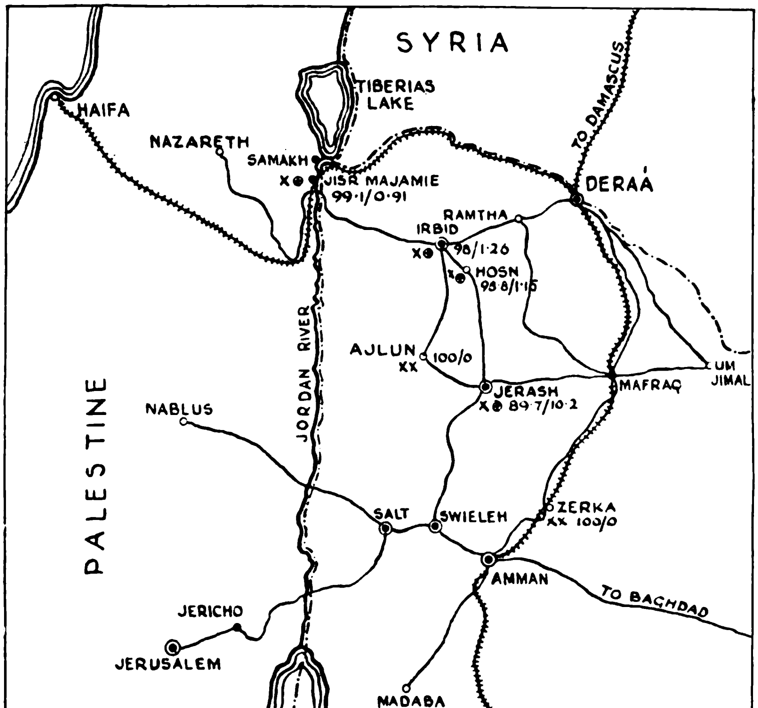
In 1938 Adler and Theodor proved that in most parts of the Near East and Palestine *P. major* and *P. syriacus* were the main carriers of visceral leishmaniasis. In view of these facts and the numerous *P. papatasii* found in Zerka village it was thought that *P. major* or other Phlebotomus of the major group might be found in Transjordan. Continual search was carried out in Zerka, and sand-flies were also collected from other villages in Transjordan (Map 2) in an endeavour to establish the presence of this



MAP 2.—Showing the presence and relative numbers of *P. papatasii* and *P. major* in some villages in Transjordan. The first number indicates the percentage of *P. papatasii* and second *P. major*, i.e. 10/20 means 10 per cent of *P. papatasii* and 20 per cent *P. major*.

species of Phlebotomus. Catches were carried out about two hours after sunset. All were identified according to Adler's method. The dates on which these catches were made and the species of sand-fly are shown in Table I.

From the results of these examinations carried out on very small numbers of catches, it was obvious that *P. major* was scattered widely

throughout the country and that it existed in comparatively few numbers as compared to *P. papatasii.*

As in Palestine, *P. major* would appear to be the probable vector of infantile leishmaniasis in Transjordan, but without culture and feeding experiments this vector cannot with certainty be incriminated.

TABLE I.—SHOWING SAND-FLIES EXAMINED IN TRANSJORDAN.

Place	Date	Numbers caught			Species of Phlebotomus
		Male	Female	Total	
Zerka	20/6 to 6/9	778	2,334	3,112	All *P. papatasii*
Irbid	14/8 to 15/8	90	68	158	*P. major* males 3 Remainder all *P. papatasii*
Hosn	16/8 to 17/8	68	105	173	*P. major* males 2 Remainder all *P. papatasii*
Ajlun	18/8 to 19/8	18	131	149	All *P. papatasii*
Jerash	20/8	106	90	196	*P. major* 19 males, 1 female Remainder *P. papatasii*
Jisr El Majamie	8/9 to 11/9	38	70	108	*P. major* 1 male Remainder *P. papatasii*

SUMMARY.

(1) An early case of infantile leishmaniasis in a male child of two years is described. This is of interest, as it is the first case recorded in Transjordan.

(2) There is no evidence to show that the disease was contracted outside Transjordan; it originated in Zerka village.

(3) Investigations amongst the inhabitants of all ages in Zerka village revealed no further cases. Neither were any cutaneous infections found.

(4) Autopsies on dogs revealed no visceral or cutaneous lesions.

(5) Sand-flies from villages in Transjordan were examined and *P. major* was found widely distributed, but in comparatively small numbers. It was not found in Zerka village.

(6) *P. papatasii* was widely distributed in all villages in large numbers.

(7) In Transjordan, as in Palestine, *P. major* would appear to be the probable vector of infantile leishmaniasis.

ACKNOWLEDGMENT.

My thanks are due to Professor Adler and Doctor Theodor for their kindness and help in the identification of sand-flies; to Dr. Stuart and Dr. Blofield for confirming the diagnosis; and to Dr. Abu Rahmeh, Director,

Public Health Department, Amman, for his co-operation; and to my staff who helped collect sand-flies.

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AN OUTBREAK OF TWENTY-EIGHT CASES OF CHOLERA AMONG BRITISH TROOPS IN BENARES DURING SEPTEMBER-OCTOBER, 1912.

BY COLONEL H. W. GRATTAN, C.B.E., D.S.O.

The following notes include a description of :—

(1) The measures taken to crush the outbreak.

(2) The search for the source of infection.

(3) The administrative action taken by the Sanitary Officer, Army Headquarters, Simla (the late Sir Robert Firth), which led to the discovery of the source of the infection.

(4) Laboratory notes on the viability of the cholera vibrio in dairy produce.

Cholera was a subject of special interest to me as my predecessor, Major Jimmy Weir, R.A.M.C., had died from this disease. He was taken ill while travelling by train from Calcutta to Darjeeling. The source of the infection was not traced.

Early in October I received orders to proceed forthwith from Naini Tal, U.P., to Benares to assist the Senior Medical Officer in dealing with an outbreak of cholera.

At the time I was Sanitary Officer, Lucknow Division.

My trained laboratory assistant (a British infantryman and nursing orderly) and I travelled all night and arrived at Benares next morning.

After reporting my arrival, I learned from the Senior Medical Officer and Officer Commanding Station Hospital, that the trouble began suddenly on September 28, when some British infantrymen were admitted to hospital suffering from cholera.

At that time the Benares garrison consisted of the Headquarters and four companies of British infantry and a battalion of Indian infantry. The Cantonment was situated about two miles from the City of Benares, the population of which was about 250,000.

All the cases of cholera, with one exception, had occurred among the non-commissioned officers and men of the British infantry.

The only officer attacked was the Officer Commanding the Station—the Commanding Officer of the Indian infantry battalion.

On my arrival, among the measures which had already been taken to control the outbreak were the following :—

All the milk and water for drinking and cooking purposes were boiled under regimental arrangements. Fresh fruit and vegetables were forbidden and no hawkers were allowed in cantonments.

Fresh cases of cholera continued to occur and it appeared that it would be necessary to vacate barracks and march out to a camp.

After a preliminary consultation with the Senior Medical Officer, I interviewed the patients in hospital suffering from cholera, who were in a fit state to be questioned, to find out which articles of food and drink were common to all.

Meanwhile my assistant was assembling the bacteriological equipment, which we had brought with us, in a room of the hospital. We brought a large rectangular Koch's sterilizer, a home-made incubator and a generous supply of glassware, reagents and spares for primus stoves. The glassware was packed in a special case made to fit under the seat of a railway carriage.

The Staff Surgeon, Captain Gatt, R.A.M.C., took me to see the only officer who was suffering from cholera, Lieutenant-Colonel ——, the Officer Commanding the Station. He did not live in the Indian Infantry Mess as he was married. He was being nursed in his bungalow, and was too ill to express any views regarding possible sources of infection. All necessary particulars regarding supplies were obtained from his head servant, as the patient's wife was absent in England.

It was now evident that there were only two articles of food and drink which were common to all the cases of cholera :—

(1) Water from the Benares municipal supply.

(2) Butter from the British infantry dairy.

An inspection was then carried out of the British lines, including the dairy which was under the supervision of a non-commissioned officer. The cows were kept by Indians who milked the animals in the vicinity of the dairy. At the time of my visit there was no milk, cream or butter in the dairy with the exception of traces of butter in the churn. No sample was taken for examination. I was impressed with the fact that the only officer who was suffering from cholera obtained butter from this dairy, and I now had evidence on which to base further action.

I saw the acting Officer Commanding Troops (the Officer Commanding British Infantry) and recommended that all fresh dairy supplies be forbidden forthwith, that the dairy in the British lines be closed, and that tinned milk, butter and jam be issued instead.

The Commandant replied that his men could not get on without fresh butter. When, however, I reminded him that several of his men had died from cholera, that further action was necessary, and had explained the grounds for my recommendations, he immediately issued the necessary orders.

The above recommendations were made the day following my arrival in Benares.

As far as I can remember three fresh cases of cholera occurred within the next twenty-four hours and two more the following day. Then the outbreak ceased abruptly.

The intense moist heat and stillness of the atmosphere made our work

very difficult and was most depressing, especially as there was no relief from the heat at night. The Senior Medical Officer and I did not grasp that we had crushed the outbreak until some time later, when additional facts became known regarding the source of the infection.

The Water Supply.

There was no piped supply in cantonments. Water for drinking and domestic purposes was obtained from the Benares Water Works from a hydrant about two miles from barracks. The water was conveyed thence in covered watercarts which were drawn by bullocks. Each cart consisted of a large wooden barrel on wheels. The barrel was fitted with a covered inlet and a tap both of which could be locked.

After the cart was filled from the hydrant and the cover locked it appeared impossible for the driver to tamper with the contents or fill the cart from an unauthorized source. The British infantry detachment had four of these vehicles—one for each company. Water for other purposes was obtained from a number of shallow wells in cantonments.

The Examination of the Water Supply.

I arranged :—(1) to take a sample from each vehicle and examine it for the presence of the cholera vibrio and then to flush out the barrel with a solution of potassium permanganate; (2) to inquire into the medical history of the Indian watercart attendants and their families; (3) to examine in a similar manner samples of water from the wells in the vicinity of the British infantry lines and then cleanse the wells with potassium permanganate.

The distribution of the cases of cholera did not coincide with the daily round or route of any one of the four water carts. These vehicles did not follow the same route every day.

Laboratory Notes.

The search for the cholera vibrio was carried out in two stages :—

(1) By the addition of an appropriate dose of sterile 10 per cent peptone and 5 per cent salt solution to the suspected sample, and incubation of the mixture at 37° C. overnight.

(2) Testing a portion of the above for the presence of the "cholera red" reaction.

If this reaction was found to be present, another portion of the sample which had been enriched with peptone was plated on nutrient agar with a slight but distinct alkaline reaction to litmus paper. After incubation likely colonies were tested for agglutination with cholera serum. When isolating vibrios from the dejecta of cases of acute cholera, direct plating was employed.

In order to satisfy myself that we were dealing with true Asiatic cholera I sent a pure culture of a vibrio, isolated from a patient in the hospital, to Colonel Rogers, I.M.S., in Calcutta (now Sir Leonard Rogers). I received a reply by telegraph stating that the organism was the vibrio of Asiatic cholera.

All four samples of municipal water from the watercarts proved negative. I then commenced to examine samples from the many wells in the British infantry lines. After several samples had been tested with uniform negative results, a false alarm occurred.

The "cholera red" reaction was apparently obtained from a sample drawn from the well adjoining the Mineral Water Factory. This caused great excitement in the laboratory. Many agar plates were expended but never a colony which showed even a trace of agglutination with the specific serum.

It was then discovered that the reputed "pure" sulphuric acid, which I had obtained from the Medical Stores, was at fault. My stock of pure acid, which we had brought with us, had run out and the work of examining the wells was discontinued until a fresh stock of acid was obtained from my laboratory at Naini Tal. The water from these wells was most unsatisfactory judging from the offensive smell given off from the samples during incubation.

Having failed to demonstrate the presence of the cholera organism in the water supply, I sent in a report on the outbreak to my chief, Major-General MacNeece, C.B., and also a copy to the Sanitary Officer, Army Headquarters, Simla.

A reply was received from Sir Robert Firth that in view of the importance of the matter he was sending further help and had detailed Captain Cunningham, Sanitary Officer, Sialkote Division, to assist in making further inquiries.

After Captain Cunningham had reviewed the position he suggested that we should go to Benares City and see what we could find out there. We interviewed the Medical Officer of Health, Benares City, an Anglo-Indian, who informed us that twenty-five deaths from cholera had been registered during September. He gave us the names and addresses of the deceased persons and provided us with a guide.

After the fourth or fifth visit we came to the home of a patient who had died from cholera on September 29. She was the wife of an Indian cow-keeper, and they lived in one small room which we inspected. In the room in which the woman had died we saw some large earthern shallow vessels about two feet in diameter. One or two cows were kept in the vicinity and milk was set for cream in the earthern vessels referred to. We inquired what happened to the cream, how was it disposed of? We were informed that it was taken to the Indian contractor at the British

infantry dairy in cantonments. Both Captain Cunningham and I felt convinced that the source of the infection had now been traced.

It appeared that the demand for butter from the British dairy was so great that the contractor could not produce the required amount of cream in cantonments. The non-commissioned officer in charge of the dairy had no knowledge that dairy supplies were brought into the dairy from unauthorized sources.

After returning to Naini Tal I made some observations on the viability of the Benares strain of cholera vibrio in milk, cream and butter. The outcome of these tests was that sour milk and cream have a marked lethal effect on the organism.

The presence of *B. coli* in milk in India appears to act as an important safeguard against cholera—a merciful provision of Nature. Although cholera is endemic in many of the large towns and cities in India, outbreaks of the disease among troops are rare.

The laboratory tests carried out were very incomplete. A test tube containing a twenty-four-hour culture in peptone and salt was mixed with a tumblerful of milk and the mixture incubated for twenty-four hours at 37° C. A similar test was made and the mixture left at room temperature (which would correspond to the temperature of the month of June in England). Although the milk had been inoculated with a massive dose of the vibrio—I failed to recover the organism.

Similar tests were carried out with cream with a like negative result. My textbook showed that the cholera organism would live for a month in sterile milk.

I then turned my attention to butter. About four ounces of butter in a saucer were infected by pouring a test tube full of a twenty-four-hour culture over the surface of the butter, which was then kept covered in the dark at room temperature.

Daily tests were made (Sundays excepted) by taking a platinum loopful of butter from the surface and inoculating a tube of peptone and salt. After incubation at 37° C. overnight, the culture was plated. The cholera vibrio was recovered from the butter daily up to twenty-one days from the date of inoculation. Tests were made for a further period of one week with uniformly negative results.

As the medium commonly used to enrich the growth of the cholera organism contains 0·5 per cent salt, the addition of salt to butter and cream as a preserving agent may increase the possibility of a chance infection.

THE TRAINING OF A TERRITORIAL FIELD AMBULANCE IN CAMP.

By Lieutenant-Colonel W. A. LETHEM, M.C., M.D.,
Royal Army Medical Corps (T.A.).

Every Commanding Officer of a Territorial Field Ambulance must be grateful to the officers who have written on this subject in recent issues of the Journal. They have made many new and useful suggestions for training, though I venture to think that a few of the schemes described may not prove to be as satisfactory in practice as they appear to be on paper.

I once met a Commanding Officer from another Division who described a field day in which the whole work of a field ambulance had been carried out in skeleton. He had travelled many miles in his car and remarked how instructive and interesting the day had been. Later, I met one of his men and, in the hope of picking up some tips, asked him what he had done. He replied somewhat as follows :—

"Well, sir, my lot sat about camp for a bit until the lorry came back with the rations. Then we crowded in and drove to A——. We got out and had a smoke and then Captain B—— turned up and led us over a ploughed field to a wood where we found Captain C—— and three men. We carried the men back about a quarter of a mile (it was a hot carry) and put them in the lorry and waited a bit while it took them back to camp. A despatch rider brought a message to the Captain and then we all got in again and drove to D——, a village I didn't know, and ate our dinners and had a sleep. Then Major F—— came along in his car and said we were at the wrong place, so we all got into the lorry again and went back to camp for tea."

Further inquiries showed that he knew quite well what he was supposed to have been doing, but one could hardly say that he had had an interesting and instructive day.

Perhaps it may be of interest to outline the system of training adopted in my own field ambulance. Firstly, it has been found impossible to combine the training of officers and men in camp, except in so far as the officers are responsible for the training of the men. In this Division we are fortunate in having officers' T.E.W.T.s at least once a year, sometimes for single days and sometimes for week-ends, and such matters as the siting of dressing stations, the writing of reports and messages, and the organization of transport, are to my mind better dealt with there than along with the men in camp.

The men should, of course, know the system upon which a field ambulance works, but they are quite capable of imagining a M.D.S. miles away or the transfer of an A.D.S. from one site to another without spending weary hours huddled in lorries or smoking cigarettes behind hedges. On active service stretcher bearers in a field ambulance are little more than beasts of burden with a knowledge of first aid, and their main work is carrying stretchers over ground too rough for wheeled transport. This hardly forms suitable employment on what, to many of the men, is their only holiday and one of the advertised attractions of joining the T.A.

The only camp programme arranged is kept in the orderly room for the benefit of inspecting officers. It is never adhered to, and in fact each day is planned according to the weather, a fair weather and a bad weather programme being always ready. Everything savouring of ceremonial and military routine is reduced to a minimum—a policy which is anathema to the spit and polish school and which offends a few old serjeants, who, having learned the drill-book by heart, regret any lost opportunity of airing their knowledge. The serjeants have, of course, their own companies, but the corporals are given half companies and the lance-corporals tents, and they are all encouraged to take a special interest in the training and welfare of their own men. Everything possible is done to develop a sense of command and responsibility in the N.C.O.s, each of whom is responsible for some particular group of men or for some particular duty. On the first morning there is instruction in laying out kits but the sole kit inspection is on Sunday. Church parade and one previous drill constitute the only time spent on ceremonial. In camp, as in the drill hall, all training is done by the officers and N.C.O.s, the P.S.I., excellent though he is, being largely confined to the orderly room and to giving occasional instruction to junior N.C.O.s. Almost the only work on the parade ground is an occasional "shouting parade" for N.C.O.s in giving orders, an exercise not possible in the drill hall, practising saluting and delivering messages correctly, which is better performed in uniform than in civilian dress, the pitching and striking of bell tents and marquees, the improvisation of stretchers and the loading of ambulance cars. These parades come in useful for filling up short days. The men have been thoroughly trained in squad and stretcher drill during the winter and there is no need to repeat the work in camp, though squad and section formation marching is practised to some extent in the field.

As to field work, great pains are taken to select different ground each day and to prepare every scheme beforehand. Many evenings are spent in examining the country and selecting sites. The ground is always chosen with a particular object in view, sometimes it is deep bracken to train in searching, requiring some organization by junior N.C.O.s, sometimes in

deep woods, sometimes in broken ground, giving training in scouting and taking cover, sometimes in a deserted farm or ruined castle, sometimes down precipitous hills necessitating hand carriage. On several occasions schemes have been held in historic ruins to which entry can be obtained on payment of a small fee paid out of the unit funds. Custodians are usually old soldiers and have always proved obliging, while the astonished visitors who may happen to be present go home, I hope, to advertise the joys of life in the T.A. Occasionally casualties are taken across a river or canal with improvised rafts or borrowed boats, though never, I am afraid, with such an elaborate structure as that illustrated in the May issue.

Whenever possible training finishes by midday, when the men embuss to the beach and bathe before dinner, which is sent out hot in hay boxes and eaten in various stages of undress. Then a long sun bathe and back to camp for games and tea. Should any Commanding Officer hesitate to indulge in bathing before dinner let him salve his conscience by calling it "physical training." Incidentally, physical training classes and boxing classes, both of which count as drills, are held at headquarters throughout the winter.

Frankly, most exercises tend more to the work of regimental stretcher bearers than ambulance bearers, but the collection and dressing of wounded does occasionally fall to the lot of an ambulance bearer. Invitation to take part in regimental or brigade field days are always refused as a waste of time, though occasionally the whole unit has been taken to a commanding hill top to watch a battle, when the positions where the R.A.P.s, A.D.S., and M.D.S. would be situated and how the transport work would be organized is pointed out. Wounded are usually labelled and each stretcher squad is required to find and dress its case properly. This, it is true, is a repetition of the winter's work, but I find that the men are extraordinarily keen on putting on splints and dressings under service conditions, and the finding and dressing of a case in the open is more interesting than the mere clearing of a hypothetical R.A.P. After collection at the A.D.S. an officer gives a short lecture on each case. There are more possibilities of variety than might at first appear. Casualties can be placed on roofs, up trees, in cellars, in dense thickets or across walls and streams, giving scope for much ingenuity in hand carriage and improvisation. Mustard gas can be simulated by scattering flour secretly on the ground to be crossed. Each scheme is explained beforehand on the ground and plenty of shell-fire, machine-gun-fire, gas attacks and hidden snipers included, giving the N.C.O.s and squads training in choosing their ground and taking cover. Sometimes a problem is included such as the collection of the crew of an aeroplane crashed on ground exposed to enemy fire, or the dressing and removal of a compound fracture from an almost inaccessible position. Such conundrums offer scope for

endless arguments. Needless to say unexpected casualties among the senior N.C.O.s are common, giving junior N.C.O.s an opportunity of showing initiative and taking command.

At least one short day is filled with map-reading. The method used is to arrange the men in parties of five or six, usually according to tents, as friends usually sleep together. They are taken out in lorries and are dropped on given map references some five miles from home. Each party is provided with a map, supplied by Division, and is required to find its way back to camp across country or to a given point if the camp is too conspicuously placed, studying the map all the way and identifying its features. The value of such an exercise depends very much upon the men themselves, but few men have had even the experience of the average motorist in studying maps, and most are interested. Many are at first inclined to argue that the map must be wrong! We usually have one night bivouac, which is very simply run. All that is required is a number of 1¼-inch deal poles of suitable length, sharpened at one end and notched about an inch from the other end, several balls of thick twine cut into lengths and a quantity of 6-inch nails. The men parade about an hour before dusk, march to a selected spot (beware of mosquitoes!) out of sight of camp and pitch their bivouacs. Stores, blankets and spare ground-sheets can be carried on a lorry. Camp is struck at the usual hour of reveillé and the men are back in camp in time for breakfast. Night manœuvres, usually the repetition of a day's scheme on ground near camp, are also held if possible, and experience shows that the scheme must be a very simple one. I have never found the men complain of giving up two evenings to training. Walking out costs money and the joys of a seaside town soon pall.

The holiday side of camp is not forgotten, for to many men this is their only holiday. Excursions, usually in uniform, are arranged to such attractions as a military tattoo, an R.A.F. aerodrome, or a tank or artillery display. One whole day near the end of camp is usually devoted to a purely holiday outing, towards the expenses of which the officers contribute, as, for example, a boating excursion to a lighthouse, a visit to a naval dockyard in Navy Week, or one year, when at Folkestone, a day in Boulogne (in civilian dress). Such outings may not be in accordance with King's Regulations, but they undoubtedly help to keep the unit above full strength, while the various competitions won and the large number of Nursing Orderlies, Class III and II, would suggest that the time lost has not seriously interfered with the year's training.

I offer these suggestions for what they are worth and am grateful for those I have already received. The conclusion is that any Commanding Officer who keeps his men doing stretcher drill and loading ambulance cars in camp must be sadly lacking in imagination.

Editorial.

THE STATE OF THE PUBLIC HEALTH.

THE Report of the Chief Medical Officer of the Ministry of Health for 1937 will be of great interest to all officers of the Corps.

The Report commences with an Introduction dealing with Specialist Services and the Public Health. Sir Arthur MacNalty points out that the science of public health is a compendium of specialized knowledge which has been applied with great success to environmental conditions of populations. The physician, surgeon, architect, engineer, and statistician have all played a part in the service of public health ; but, in the extension of public health to the diagnosis and treatment of disease, different and more personal conditions prevail.

During the past thirty years increased duties and responsibilities have been imposed on the Medical Officer of Health and now that the people's health is a direct concern of the State, it is essential that the local health expert should be a medical man capable of advising his Council on measures for the prevention and treatment of disease.

The different specialist services which can be provided by Local Authorities may be enumerated as follows :—

Services under Maternity and Child Welfare ; Services under Tuberculosis schemes ; the School Medical Service ; the Orthopædic Service ; rheumatic diseases ; venereal diseases ; cancer ; endocrine diseases ; infective diseases ; nervous diseases ; influenza and pneumonia ; specialist provision at the hospitals of local authorities ; specialist provision at voluntary general hospitals.

Pathological facilities for the diagnosis and treatment of a large number of diseases were urged in the Report of the Chief Medical Officer of the Local Government Board for 1912-13, but the Great War postponed central action.

Since that time increased pathological facilities have been provided, and for ordinary diagnostic purposes a general practitioner can obtain free of charge through the local authorities the tests which he usually requires to aid him in the diagnosis and treatment of diseases.

From this account it is evident that a large amount of specialist advice and treatment is now provided for the community by existing services. It is difficult to estimate the specialist needs of the community, but it has been suggested that in 5 per cent of patients seen, general practitioners desired specialist consultation.

While specialist provision does not cover the whole of the needs of the people, the lines of development have been indicated. A hospital link in such service is very important for in most cases it is of little avail to

provide merely specialist advice without concomitant facilities for treatment at a large duly equipped and well-staffed hospital.

Present circumstances will not permit of a complete and comprehensive scheme of service by local authorities in the near future, but it is thought that considerable development could be effected by wise administration and goodwill with little expenditure of public money.

The population of Great Britain as enumerated at the census in April, 1931, was 44,795,357. The estimated mid-year population in 1937 of England and Wales was 41,031,000.

The number of births registered was 610,557 representing a birth-rate of 14·9, which is a slight improvement on the rate of 14·8 for 1936.

The crude death-rate in 1937 was 12·4 per 1,000 persons compared with 12·1 in 1936 and 11·7 in 1935. The standardized death-rate was 9·3 per 1,000 persons compared with 9·2 in 1936 and 9·0 in 1935.

The five principal certified causes of death at all ages were: (1) Diseases of the heart and circulatory system; (2) cancer, malignant disease; (3) bronchitis, pneumonia and other respiratory diseases; (4) diseases of the nervous system; (5) all forms of tuberculosis.

When the causes are set out in order of magnitude for the age period 16-65, man's working life, the diseases of the heart and circulatory system take the first place, then come cancer, all forms of tuberculosis, bronchitis and respiratory diseases; diseases of the nervous system take the fifth place.

The infant mortality was 58 per 1,000 births, as against 59 in 1936, and 57 in 1935. The decrease in infant mortality during the last thirty years has been remarkable and no spectacular improvement can now be expected since the lower the rate, the nearer the irreducible minimum is approached.

In the Annual Report of the Chief Medical Officer for 1933, Professor Greenwood and Dr. Bradford Hill gave a review of the trend of mortality in early childhood and in adolescence. Their data showed that in the relative absence of State public health services on behalf of the pre-school child the greatest improvement in mortality over the past three-quarters of a century had been recorded at ages 1 to 5 years. In 1926-1932 the mortality of each year of life from 1 to 5 years was rather less than one quarter of the mortality registered in 1861-70. The improved trend of the death-rate has continued and compared with the rate of 1861-70 mortality at 1 to 5 in the most recent years is only about one-sixth of the earlier level.

In the most recent years the death-rates from measles, scarlet fever, whooping-cough and tuberculosis have been rather less than one-third of their level in 1912-1914, bronchitis and pneumonia have fallen by 61 per cent, diphtheria and violence by one-third, while deaths attributed to diarrhœa and enteritis are only 12 per cent of the pre-war level. These

figures denote a considerable saving of child life. But as a single cause group bronchitis and pneumonia still remain the greatest risk to life in early childhood.

Gratifying as these figures are in the main, it must be remembered that at these ages of childhood exceedingly large variations in mortality are to be found between the geographical and administrative areas of the country. In 1935 the rates in the northern counties were one-third in excess of the rates for the whole country; in the south and east they were 20 to 30 per cent below. Similarly, the rates in county boroughs were nearly double those in the rural districts.

The Registrar-General has repeatedly drawn attention to these contrasts, and has concluded that the mortality of young children from the principal causes of death in the county boroughs is more closely associated with the proportions of the populations living under overcrowded conditions than with the geographical situations of the towns.

In nearly all experience the rate of mortality is least in the twelfth year of life; from that age it increases at first slowly and then faster, with an acceleration which ultimately diminishes.

Under the conditions prevailing a century ago a little over half the children who lived to the age of eleven survived to sixty, 52·9 per cent of the males and 54·0 per cent of females. By the experience of 1930-32 almost three-quarters, 71·6 of males and 77·2 of females will live from school age to an age which in some services qualifies for pension. In other words, the chances of males surviving to a pensionable age have improved nearly 38 per cent, and of women nearly 43 per cent.

The large group of infectious diseases is roughly divisible into two types: (1) Those like cholera, typhus, typhoid, plague, dysentery and malaria, which for their propagation require a particular environment, and (2) Those which are spread by personal contact, probably by droplet infection, as, for example, diphtheria, scarlet fever, and cerebrospinal fever.

The diseases which have almost disappeared are those of environment, while those spread by personal contact remain. Practically all the personal diseases occur in persons under 15; those above this age are for the most part immune, although a large proportion of them have never suffered from the diseases in a recognizable form.

Inasmuch as immunity is specific it is concluded that all these persons have been exposed to subclinical doses which, in process of time, have by repetition sufficed to produce immunity. Confirmation of this in diphtheria is forthcoming in the frequency with which a natural Schick-negative reaction is met with; and the antibodies of poliomyelitis are to be found in the blood of persons who have never suffered from the disease. The sources of this immunity are "silent" carriers of the specific organism, who may on occasions be responsible for avowed cases of the particular disease—measles, scarlet fever, diphtheria, or any other personal disease.

Notifications represent the clinical cases that occur from time to time, and which are but a fraction of the total amount of infection present. Little fluctuation is recorded year by year in the large number of cases of measles, scarlet fever and diphtheria. Their prevalence shows little diminution, but happily they are less fatal.

Notification, isolation and disinfection, coupled with improved sanitary conditions, have done their work and have accounted for the virtual disappearance of cholera, water-borne dysentery and typhus fever. To-day measles, scarlet fever, whooping-cough and diphtheria are of special concern to the guardians of the public health. Their incidence still remains high, and prevention against them has engaged the attention of medical research for many years.

In 1937 three cases of variola major were notified, and one case of variola minor occurred in Derbyshire.

Five cases of acute nervous disease following vaccination were reported in 1937. The diagnosis in these cases was based on clinical findings combined with, in fatal cases, pathological appearances. In none of the fatal cases was the brain and cord submitted to the prolonged technique necessary to confirm the diagnosis of post-vaccinal encephalitis. The cases fall into line with others previously seen, but they differ in that four out of the five were not more than six months old.

Cases continue to be reported in Europe in much the same circumstances as in England, but some are reported to occur much earlier after vaccination. Two fatal cases in Germany were reported within two hours of vaccination, and it seems doubtful whether we are dealing with one and the same clinical entity. Encephalitis has been reported as a sequela of common infectious disease. In whooping-cough encephalitis is apt to occur in young infants, whereas in scarlet fever the age of predilection is that of late childhood. The incidence of post-vaccinal nervous disease falls largely on children of school age and adolescents. Primary vaccination at these ages, except in special circumstances, has repeatedly been deprecated by the Ministry, and it is regrettable that some employers decline to engage individuals unless they can show evidence of successful vaccination.

In 1937 there were 95,737 notifications of scarlet fever with 349 deaths, giving a fatality rate of 0·36 per cent.

Sir Arthur MacNalty says "the large incidence of the disease continues with depressing regularity, although it represents merely one manifestation of a very large group of epidemiologically allied conditions which include follicular tonsillitis, pyrexia, erysipelas, puerperal fever, and probably other conditions. Only those cases which exhibit the cardinal physical signs of headache, vomiting, sore throat, and rash, are notified; these cases alone are in many districts systematically removed to hospital

leaving unisolated many cases of infection with kindred organisms which are a source of danger to the community. To remove all patients exhibiting clinical manifestation of hæmolytic streptococcus infection is obviously impossible and unnecessary; but in many districts "rash," notification, and removal are almost synonymous terms in spite of the practice having been repeatedly deprecated by the Ministry, who hold that wherever possible uncomplicated cases of scarlet fever should be treated at home and thus removed from the dangers of cross infection which are at present inseparable from the routine system of hospital isolation as commonly practised.

The work of Allison and Gunn has shown why the isolation hospital has failed to diminish the incidence of scarlet fever; they produced evidence that removal was calculated rather to increase the incidence. Their further experiments have shown that of 47 patients nursed in a multiple-bed ward and swabbed twice weekly during their period of detention, 33, or 70 per cent, became re-infected with a serological type of *Streptococcus pyogenes* different from that causing the primary disease. Moreover, in nearly one-half the cases the re-infection was latent and gave rise to no clinical signs. They have confirmed their earlier observations with regard to cubical isolation in scarlet fever, and ideally every scarlet fever patient should be nursed in a cubicle, and should not be placed in a multiple ward with patients whose condition is due to a different type of streptococcus.

In present circumstances typing of cases before admission to hospital is clearly impossible, and attempts are being made to segregate patients on geographical and time considerations. Patients coming from a common vicinity or from the same school and who were infected probably at the same time are to be housed together on the assumption that infection might be due to the same strain of organism.

The Immunization Committee continues to consider the possibility of scarlet fever immunization, a practice which the Ministry, at present, has not seen its way to advocate. The committee consider that under strictly controlled conditions immunization has some value in isolation hospital practice; its success is somewhat limited, and the process is accompanied by certain disabilities which prevent its general advocacy at the present time.

A somewhat disquieting series of cases of acute infective jaundice was reported during the year; the symptoms and physical signs of the majority differed little from those of epidemic catarrhal jaundice which had been prevalent in the district chiefly affected. A small number were very ill with moderate pyrexia, vomiting, abdominal pain, and diminished area of liver dullness, bleeding from the nose, urticaria, delirium and increasing drowsiness; they died with all the classical symptoms of acute necrosis of

the liver. On inquiry it was found that some of them had been in contact with cases of measles sixteen to one hundred days or so before and had been given convalescent measles serum of the same batch. Unused serum was recalled and found to be sterile and non-toxic, and contained a quantity of antiseptic. Between 82 and 109 persons were inoculated with this serum. Jaundice occurred in 37, of whom 7 died. No record can be found of a similar course of events following the use of measles serum, and inquiry of some of the largest users of this serum on the Continent of Europe and in America were equally negative.

In view of the fact that acute necrosis of liver is well known as a cause of death in acute infective jaundice, which occurs spontaneously in sporadic and epidemic form, some competent observers regard the combination of circumstances as fortuitous; it seems remarkable that the sequence, had it occurred, should not have been marked in American practice.

It is hoped that these unfortunate results are exceptional. The serum implicated so far has been confined to two small batches. There is no known infection or allergy which will account for all the observed facts. Abnormal occurrences of this kind do not imply that treatment by measles convalescent serum should be discontinued, for it has shown its value in saving life and mitigating the severity of attacks of measles.

The whole subject of acute infective jaundice following the administration of serums is under investigation, and the medical department of the Ministry would be glad if Medical Officers of Health would report any cases of jaundice which come to their notice following the administration of measles convalescent serum within a year after the serum has been given.

During the year, 2,151 cases of enteric fever (including paratyphoid fever) were notified with 206 deaths, giving a fatality rate of 9·6 per cent.

The majority of the cases were widely scattered and occurred in small groups; but there were two large outbreaks, one of paratyphoid fever in Liverpool, Bootle and adjacent districts and the other of enteric fever in Croydon.

In the Liverpool outbreak the infection was traced to an area which coincided with the area of distribution of bread from one source. After a close examination a carrier of the paratyphoid B. organism was found whose duty it was to handle the loaves before they were despatched from the bakery. The circumstances of the rise and decline of the outbreak were compatible with the hypothesis that the infection of the bread was derived from this source. Dr. Frazer reporting on the outbreak stated that paratyphoid B. could be recovered from bread crusts for thirty-three days after a heavy inoculum, and up to the sixth day with a slight one of 120 organisms.

In the Croydon outbreak there were 310 cases of typhoid fever, and 30

associated cases were notified in other districts. The immediate cause of the outbreak was found to have been infection by the typhoid bacillus of that portion of the public water supply of the town derived from a chalk well at Addington. The circumstances pointed to this well having been infected by a chronic typhoid carrier who was one of a party of men working in the well at that particular time. During the whole of the time that work was in progress, untreated water from the well was being pumped into the general supply. There had been no medical examination, however cursory, of the men selected for work in the well, and the arrangements for their sanitary convenience when at work were unsatisfactory.

An outbreak of enteric fever occurred in the Maesteg Urban District. Eleven persons were found to be suffering from the disease and two died. The source of infection was considered to be a carrier, a case of pyelitis of long standing with positive Widal of low agglutination titre.

During the year 4,167 cases of dysentery were notified in England and Wales. In previous Annual Reports, reference has been made to the certainty that bacillary dysentery due to Sonne and Flexner infections is endemic in this country, and that it escapes notice not only in private practice but even in the wards of hospitals. The prediction was made that many cases of gastro-enteritis, gastric influenza and coli infection would be more properly described as bacillary dysentery if laboratory examinations of the stools were made in the acute stage of the disease. This prediction was fulfilled in 1935 and 1936. In 1937 notifications were beyond expectation: a proportion of the increase was probably due to the employment of laboratory aids to diagnosis and to a wider knowledge among general practitioners that Sonne dysentery is notifiable. The Ministry have received reports of outbreaks in which no cases have been notified, and it is thought that in 1937 the number of notifications did not represent fully the unprecedented prevalence of the disease and perhaps one third of the cases were not discovered. In several of the larger boroughs and in a number of institutions routine bacteriological examinations of persons affected with dysenteric symptoms were maintained during this year, and no difficulty was experienced in demonstrating the presence of the Sonne bacillus in the fæcal specimens.

The incubation period of Sonne dysentery varies from a few hours up to two days and the illness only lasts three or four days. Convalescence is rapid and there is no indication of chronic ulceration or colitis. Sequelæ are said not to be feared as Sonne dysentery does not produce ulceration of the lower bowel, contrasting thus with Shiga and Flexner types.

In previous years it had been noted that the incidence of Sonne dysentery was mainly upon the age groups under 15 years and on the young middle age groups 25-45 years and in the latter group upon females

rather than males, that is to say on children and mothers, or women in charge of children. These observations have been confirmed, but there is little doubt that a large proportion of adults of both sexes have been affected during the recent prevalence. In spite of investigations made by many Medical Officers of Health, no vehicle of infection was discovered, save in three instances. In two small outbreaks an article of food similiar to that which had been consumed was found infected with the Sonne organism. In the third the milk supply was implicated, but the point at which the milk became infected was not identified.

In no case was a water supply proved to be involved. It has been suggested that the recent predominance of Sonne dysentery may be due to importation from abroad by persons who have been on holiday cruises to continental and sub-tropical ports. Consideration was therefore given to the problem of the human carrier; but the existence of the carrier state in an otherwise healthy person has not been demonstrated.

The number of deaths from influenza in 1937 was 18,635, of which a large proportion occurred as is usual in the first quarter of the year. The heavy death roll was due to the excessive epidemic prevalence and not to any increase in virulence of the type of infection. Following on modern epidemics of influenza, and notably in the winter of 1925, remarkable waves of notified pneumonia have been observed. These have been neither accompanied nor followed by serious mortality from influenza. This phenomenon accompanied the epidemic of 1937.

In 1937 there were 61,339 cases of diphtheria notified as compared with 57,795 in 1936 and 65,084 in 1935. The fatality rate was 4·8 per cent as compared with 5·3 per cent and 5·4 per cent in 1936 and 1935 respectively.

Sir Arthur MacNalty writes: "In diphtheria we appear to have reached a position of stability so far as incidence is concerned, within the limits of what may be regarded as normal fluctuation, and it is doubtful if any marked diminution of incidence can be expected by procedure along the old lines of 'notification, removal and disinfection.'"

Approximately 90 per cent. of the cases occur under the age of 15 years. By that time the majority of individuals have been immunized by "subclinical" infection. The acquisition of natural immunity postulates a diphtheritic environment. It is a lengthy process and is obtained at the expense of clinical cases and possibly of deaths, whereas artificial immunity if carefully conducted by experts is without these risks and can be acquired in as many months as the natural process takes years.

In New York extensive immunization against diphtheria was begun in 1929. Before this year little attention had been paid to children of pre-school age but when 60 to 70 per cent of children under the age of 6

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years had been immunized there resulted a reduction of diphtheria incidence from 8,548 cases in 1929 to 1,143 in 1936. Later figures represent a reduction in the diphtheria death-rate in the age-period 1 to 15 from 27·4 to 2·1 per 100,000. The corresponding figures for England and Wales are 32·8 and 31·8 respectively.

In Montreal both incidence and mortality fell *pari passu* with immunization and in 1935 the figures were approximately only one-tenth of those recorded in 1927. As in New York a particular effort was made to secure the immunization of young children, and in 1935 it was calculated that 50 per cent of the children under 12 years of age had been protected.

Ontario and Hamilton show a similar record; there has been no case of diphtheria notified since 1933, and no death since 1930.

These results have only been obtained by intensive propaganda by local authorities, and it is necessary to ensure that the immune population is not unduly diluted with non-immunes in the persons of recently born infants, for as Dr. Graham Forbes has recently observed the further success of immunization must be dependent on the campaign being unremitting in order to keep the protection rate at least equal to the number of births each year.

Progress in immunization is being made in some of the larger provincial cities, though none of them has succeeded in immunizing the 50 to 60 per cent. of the child population which is necessary before the incidence of the disease is affected.

Next month we hope to continue our notes on the Chief Medical Officer's most interesting report.

6ME SESSION DE L'OFFICE INTERNATIONAL DE DOCUMENTATION DE MEDECINE MILITAIRE.

By Lieutenant-Colonel T. B. NICHOLLS,
Royal Army Medical Corps.

The Proceedings of the International Congress for Military Medicine and Pharmacy, held in Geneva in 1936, are a welcome indication that the spirit of the Geneva Convention still lives, and that international efforts to ameliorate the sufferings of the wounded are still part of the policy of the nations participating in the Congress.

The Army Medical Services of the nations continue to give the lead in the frank disclosure and discussion of the methods and of equipment devised for their humane task, a lead that might well be followed in other spheres of action.

These Proceedings also disclose the fact that the problems and difficulties of the Army medical services are much the same the world over. For example, Colonel Leman of the Belgian Medical Service laments the lack of facilities for field training. He says, referring to his own personnel, "Their training in garrison towns is rudimentary, they are never formed into units, nor do they carry out any schemes with their equipment and vehicles . . . they never take part in camps or manœuvres. . . ."

This is the complaint of nearly all medical services. In peace time they have a dual function, firstly to tend the sick, and secondly to train for war. Too frequently only the first is put into practice, and the staff is kept to the minimum for this purpose, with the result that personnel are not available to constitute medical units on manœuvres, and are therefore untrained when joining these units in war. It is remarkable, nevertheless, how they always rise to the occasion. Our own Field Ambulance Camp (Annual) is a very big step in the right direction.

Colonel Leman urges that the personnel of the medical services must nowadays be a technical "Corps d'élite"—their training must be such as to fit them for their task, a comment with which all will heartily agree.

Medicin General Schickele (France) discusses the application of the Geneva Convention to modern conditions, and points out that, at present it protects only those who are "sick and wounded of armies in the field," and that no provision for the safeguarding of civilians exists. He suggests the formation of special isolation areas or security zones for hospital centres and for the protection of factories solely producing medical supplies. He also feels that the Convention should apply to civil wars, which have no laws, and points his remarks with a reference to Spain at the present time.

Lieutenant D. Younis (Greece) gives an interesting account of an epidemic of dengue in Greece in 1928, consequent on an outbreak in 1927. This was of unparalleled magnitude and had disastrous results on medical and administrative organizations, both civil and military, while the hospitals overflowed. The campaign against the stegomyia was on familiar lines, but was made much more difficult by the presence of refugees. The author points out that it is much easier to destroy stegomyia in the winter, and recommends that this should be done in cases where an epidemic has occurred.

A contribution by Dr. M. Schitlowsky of the Swiss Army leaves one envious of the training that the Swiss Medical Service was fortunate in undergoing. The tactical exercise, which included all medical formations, lasted fourteen days. The only comparable instance that the writer can recall was the medical manœuvres held about 1907 which were intended to test the functions of the newly instituted Casualty Clearing Hospital.

Surgeon Lieutenant-Colonel Dr. Capitanouici (Roumania), contributes an excellent paper on the principles of evacuation from a division in

action. This paper shows again how the same problems affect us all. He twice remarks on the necessity of the medical services being given information—not forgetting the regimental medical officer—for without this one of the principles of war, co-operation, cannot be carried out. His remark "The efficient and early evacuation of casualties is a responsibility of the chief medical officer of the division, who should be informed of impending operations by constant contact with the commander." He further says "This principle has not often been respected in war—especially in early stages."

One frequently heard complaints in France from the A.Ds.M.S. of Divisions, that they did not live in the same Mess as the G.O.C. This deprived them of a valuable opportunity of knowing what was in their commander's mind.

Another essential principle, often forgotten, is what in our Service is termed the "Supplementary Organization." The writer points to the necessity of reinforcement of the medical service with personnel and equipment from outside sources when "peak" casualties are expected as "Their (the Medical Service's) resources are woefully inadequate at certain periods." Hence it is essential that, well in advance, additional facilities should be placed at the disposal of units about to make or resist attack.

The necessity for this "Supplementary Organization" is not always envisaged by commanders.

"Panic as a Phenomenon in War," by General Dr. Rouppert (Poland). This interesting article is in effect a plea for the study of psychology by those entrusted with leadership in war.

"With the intensive training required in all highly technical branches of military science there is a tendency to allow the problem of the psychology of the individual soldier and that of collective troops to be relegated to the background. All modern inventions require individual attention. If the individual is not known and thoroughly understood by his chiefs, the highest hopes of victory may be denied."

The writer discusses the psychology of fear and the fact that "crowd behaviour" is very different from individual behaviour. There is a tremendous amount of nonsense clustered around the word "fear." This emotion is part of the protective mechanism without which mankind could not survive. It must and does exist, and is not to be reprobated, for repression of such a powerful instinct can only lead to breakdown and "N.Y.D.'N'." It is the giving way to, and not the feeling of, fear that makes the coward. "The all important thing is to train the soldier and the Army to a strict discipline, not only an outward but an inner discipline."

It is even more important that the leaders should have a working knowledge of psychology, particularly of the perhaps unfortunately named

"herd instinct," for without this mental equipment they cannot understand their men and cannot inculcate the "inner discipline" so necessary amid the horrors of modern war.

So far the psychologist is not officially recognized in our Army, though a couple of physiologists are secreted for some mysterious purpose among the staff of the Quartermaster-General. His usefulness is not appreciated, in fact he is regarded with suspicion as being the practitioner of something closely resembling THE BLACK ART.

"Evacuation by Autorail," Surgeon Commandant L. R. Sabrie (France).

An article describing the organization and working of motor cars on railways as a method of evacuation. The author's conclusion is that the main and most effective function of motor-cars on rails is auxiliary, and complementary to the hospital train and motor ambulances and will be found most useful on light railways near the front and in Colonial wars.

"Medical Services and Mechanical Transport," Lieutenant-Colonel Dr. Bouissou (France).

This paper discusses the difficulties of the evacuation of casualties in a war of rapid movement. In particular the writer deals with the strategical handling of the French equivalent of a casualty clearing station. This, he states, will have to be sited fifteen miles from the front line. This was the distance most generally chosen in the late war, but in view of the activities of a mobile force it is doubtful if it is not far too close. It is probable that the casualty clearing station will in future have to be sited thirty to fifty miles behind, with consequent difficulties in evacuation owing to the long run of motor ambulances. He recommends also that the casualty clearing station should be mobile, and that it should have a light section, which did not appear to exist in the French Army at the time the paper was written. He is of opinion that the lightly wounded should be despatched direct to a medical base, but it is not obvious how or where the "Triage" recommended for this purpose is to be carried out.

The strategic handling and the necessity for mobility of the casualty clearing station are once again matters of great difficulty.

"The Centenary of the Largest Medical Library in the World," by Lieutenant-Colonel Edgar Erskine Hume (United States).

This account of the "Library of the Surgeon-General" at Washington, D.C., leaves us very envious of the magnificent collection available for study by the medical officers of the Medical Corps, United States Army. It terminates, however, with a lament that the building is not worthy of the most important collection of medical literature in the world.

"The Red Cross of Holland Ambulance in Ethiopia," by Dr. Veeneklaas (Holland). This is a most interesting account of the work of the Unit in Abyssinia, enlivened by flashes of humour.

The account given of the state of health of the inhabitants is harrowing;

they seem to be tbe prey of every known disease. Syphilis is so widespread as to be endemic. Typhus, typhoid, dysentery, diseases of the eye, rickets, rheumatism, and so forth, seem to afflict a vast majority.

A curious sidelight on their habits is that babies, after their first week of life, are fed on rancid butter, which is esteemed as the most nutritious form of food. Consequently digestive troubles in after years are rife, and for the relief of omnipresent constipation half-a-pint of castor oil is necessary.

The bombing of the British Unit is described; and the writer's own unit had to take refuge in wet and dark caves from air action, which made the difficulties of affording adequate treatment almost insuperable.

A moving description of the sufferings of the Abyssinians under a rain of mustard gas is given. The condition was aggravated in those men who, in escaping on horseback, sat on contaminated saddles for several hours. Their mounts often perished from the eating of contaminated grass.

As his unit was not equipped for the correct treatment of mustard cases, the author employed a very unorthodox treatment which was efficacious. He sprayed the lesions with a 5 per cent solution of tannic acid, "One would have said that it barred the exit of the poison, which would continue its action under the coagulum. We have always achieved a satisfactory cure after this treatment, and frequently one can have resource to ointments after three weeks." This is a very interesting observation, which appears to call for study. It would add a very useful weapon to our armamentarium.

Two extracts in a lighter vein must conclude this review.

The first states that in the early days considerable misunderstanding arose from the fact that in Abyssinia it is customary to mark brothels with the Red Cross.

The second relates the success of the writer in the unusual role of veterinary surgeon. Rosa, the favourite dog of the Negus, was sick and the author, who had been appointed Court Physician, was requested to treat her. The dog, which was suffering from piroplasmosis, made a spectacular recovery after the injection of salvarsan, to the delight of the Emperor. The author quaintly remarks: "The reputation of a doctor depends sometimes on queer chances!"

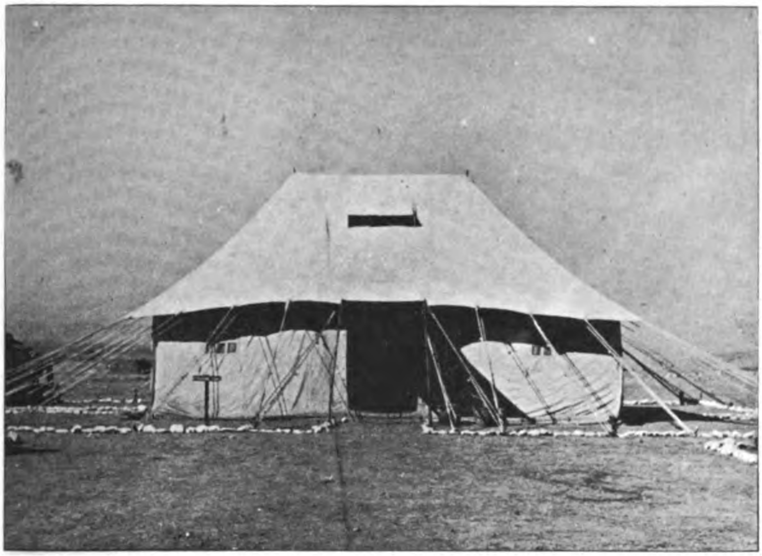
Clinical and other Notes.

TWO IMPROVISED OPERATING TENTS.

By Major F. HARRIS, M.C,
Royal Army Medical Corps.

During the operations in Waziristan, in 1937, it was found that the official pattern operating tent was unsuitable for several reasons :—

(*a*) It is difficult to carry by mule-pack transport. This double-fly tent complete with poles, ropes, pegs, etc., weighs 458 pounds, and is intended to be carried in one of the motor transport vehicles attached to the Headquarters of a Field Ambulance. The standard pattern tent, in which the



Standard pattern operating tent.

walls are sewn to the roof, cannot be carried on pack-mules as the combined weight of roof and walls is too heavy for one mule. As a result of this defect, during the operations in Waziristan in 1937, the walls were altered so that they could be detached from the roof. But, even with this modification, the loads of the tent when packed up are unwieldy for pack mules; as a result, it is usually left behind when the Field Ambulance, as often happens in operations on the North-West Frontier, moves on an all-pack basis.

(*b*) Its floor space, 20 by 12 feet, when all equipment is in position, is too cramped.

(*c*) Its door is too low and narrow.

(*d*) Its pitching space (38 by 30 feet) is too great for advanced

perimeter camps, where a Field Ambulance may have to maintain a main dressing station for a few days.

To obviate these objections, and at the same time to make use of the existing stocks of I.P. and 160-pound tents which are yearly deteriorating, two improvised types of operating tent are now proposed; one for mule-pack carriage, the other for camel-pack or wheeled carriage.

Operating Tent for Mule-pack Carriage.

The mule-pack operating tent was improvised by the Arsenal, Rawalpindi, at the instigation of the D.D.M.S., Northern Command. It is intended to use this tent when only mule-pack transport is available. As soon as tracks are sufficiently developed the modified I.P. tent described later would be taken into use.

Mule pack operating tent.

The tent now described consists of the following components:—

Two 160-pound tents complete with poles, cordage, etc.
One special canvas ridge-cover.
Two special canvas flaps to close each gable end.
Two 10-feet bamboo poles.
One additional ridge-pole, as used normally with the 160-pound tent.
Thirty iron tent pins.

To erect the tent, the procedure is as follows:—

The two 160-pound tents are joined together at two adjacent walls, by lashing the edge of each wall to its neighbour, and sealing the junction by the special canvas cover. The ridge-pole is then placed under the ridge

of one tent and the tent raised in the usual manner. The ridge of the other tent is then similarly raised. The two 160-pound tents are now erected side by side but with their adjacent walls forming an awning between the two tents. This awning is now lifted to a height of 10 feet by placing under it, at the junction of the two walls, the extra ridge-pole and by raising this ridge-pole on the two 10-feet bamboo poles. A combined tent is thus formed, 10 feet high at its central ridge and sloping on each side from this ridge to 8 feet at each lateral ridge and thence gradually to the ground. Each end of the combined tent is closed by one of the special canvas flaps, each of which is fitted with a door set to one side of the middle which can be opened or closed at will. A window can also be cut in the flap if desired. The weight of this improvised operating tent complete with all necessary fittings is 440 pounds, and it can be easily carried by three pack-mules. It has a floor space of 34 by 14 feet, and requires a pitching space of only 38 by 16 feet.

It is pointed out that this operating tent is made entirely of existing tentage (i.e. two 160-pound tents), which is not damaged in any way and which can be taken into ordinary use when no longer required as an operating tent. The flaps to close each end are made of old condemned tents and the two 10-feet central standing-poles are natural uncut bamboos in the usual length as supplied by contractors.

The extra materials (canvas ridge-cover, canvas flaps, extra ridge-pole, the two 10-feet standing-poles and the tent-pins) can easily be stored in the field ambulance and take up very little room. When the field ambulance has to proceed on a mule pack basis, all that is necessary is to draw two 160-pound tents from reserves kept for this purpose.

The advantages of this operating-tent are as follows :—

(*a*) It can be easily carried by three pack mules.

(*b*) It provides so much more floor space than the official pattern operating tent (476 as compared to 240 square feet) that two operating tables can be worked at the same time.

(*c*) It requires much less pitching space, 608 compared to 1,140 square feet, a matter of great importance in a cramped advanced perimeter camp.

(*d*) The fact that the doors are at opposite ends and are arranged diagonally enables patients to be brought to either table without disturbing the other surgical team.

(*e*) The doors are high and wide enough to permit a loaded stretcher to be carried into the tent without tilting, raising or lowering of the stretcher.

(*f*) It takes very little time to erect.

Its only disadvantage is that it is a single-fly tent; but, as already mentioned, it is intended for emergencies when only mule-pack transport is available.

Operating Tent for Camel-pack or Wheeled Carriage.

In 1937, in Waziristan, the Ordnance Services began to use as store tents, tents I.P. Privates Mark II, which, with the object of increasing their storage capacity, had been raised 3 feet higher than normal. One of these tents thus modified was seen by the D.D.M.S., Northern Command, who realized that two such tents joined together would provide an operating tent for a Field Ambulance much superior to the existing authorized pattern. These tents being readily portable, either by pack-camel or wheeled vehicles, are intended to be used as operating tents as soon as tracks have been sufficiently improved to allow the passage of camels or vehicles.

Operating tent for camel-pack or wheeled carriage.

This operating tent consists of the following components :—

Two tents, I.P. Privates Mark II, complete with standing poles, cordage, etc.

Two strips of canvas, each 3 feet in depth, to form additions for the walls.

Four 3-feet bamboo poles, to increase the height of the standing poles.

Four iron sockets, each about 1 foot long, into which the standing poles and the short bamboo poles fit.

Special wall poles, using the 10-feet bamboo pole as supplied by the contractors.

Special canvas loops sewn on to the inside surface of the walls and of the canvas strips.

To erect the operating tent, the procedure is as follows:—

The upper margin of one 3-feet canvas strip is lashed to the roof of one of the I.P. tents. Each normal standing pole of this tent is then lengthened by joining it to one of the 3-feet poles by means of the iron socket, and the roof, with the canvas strip hanging down like a fringe from it on each of its four sides, erected in the usual way. The 10-feet wall poles are then threaded through the special canvas loops (which are sewn in vertical rows 6 feet apart on the inside of the walls), and the walls erected and lashed to the lower margin of the canvas strip, the upper end of the wall pole being first thrust through the corresponding canvas loops which are sewn on the inside of the canvas strip. By this means a firm wall is produced far superior to the ordinary tent wall.

The second tent is erected in the same way, side by side with the first, and the adjacent flies of both are lashed together, with the customary waterproof sheet to prevent leakage. A specially high and wide door is provided at each end.

The weight of this combined operating tent, complete with all necessary fittings of ropes, poles, etc., is 1,534 pounds, and it can be carried by four pack-camels. It has a floor space of 31 by 20 feet, and requires a pitching space of 55 by 41 feet.

This tent also, it is pointed out, is made of existing tentage which is not damaged in any way, and which, when not required as an operating tent, can be taken into ordinary use. The extra materials (strips of canvas, short bamboo poles, iron sockets, and the special wall poles) can readily be stored until required, taking up practically no space.

The advantages of this operating tent are as follows:—

(*a*) It can be easily carried by pack-camels, and so can be used as soon as the tracks are fit for camels or wheeled vehicles (A.T. or M.T. vehicles).

(*b*) It provides much more floor space than the official operating tent (620 as against 240 square feet) and much greater height. There is thus ample space for two operating tables and full operating room equipment.

(*c*) Natural lighting is good, and the extra height makes the slinging of operating lamps considerably easier.

(*d*) The tent is double-fly, lofty, airy and cool.

(*e*) The doors are high and wide enough to permit a loaded stretcher to be carried into the tent by the tallest and broadest stretcher-bearers without tilting, raising or lowering of the stretcher.

(*f*) I.P. tents, thus modified, can be joined together in series to form excellent hospital wards.

(*g*) It is no longer necessary to keep a standard pattern operating tent so that the recurring expenditure on these tents is saved.

These tents form such eminently suitable field operating tents, and are so superior to anything we now have that it seems unnecessary to try and

design a new standard pattern operating tent in an attempt to improve on the present admittedly unsatisfactory one.

It is recommended that the existing stocks of I.P. tents should be used in this way wherever tented operating accommodation is required in field ambulance, casualty clearing station, or elsewhere.

It is further suggested that these modified I.P. tents joined together in series should be used for hospital wards in standing camps of all kinds.

In conclusion, the writer would like to thank Major-General W. H. Hamilton, C.B., C.I.E., C.B.E., D.S.O., K.H.P., D.D.M.S., Northern Command, for permission to send this note for publication, and Major G. K. Fulton, R.A.M.C., for providing the photographs and for his help in writing up the descriptions of the tents.

SHORT WAVE THERAPY.

By the INSTRUCTIONAL STAFF OF THE MASSAGE DEPARTMENT,
Royal Victoria Hospital, Netley.

This article is written with the object of stimulating interest in a comparatively new addition to the medical armamentarium.

As far back as 1888, D'Arsonval experimented with high frequency currents and later Tesla, Zeynck and others extended these experiments and produced the relatively sustained high frequency current called diathermy. To Dr. Schliephake falls the honour of introducing the science of short wave therapy and his book on the subject, published in 1935 after seven years of continuous research, first provoked world-wide interest in this form of therapy. It is fairly certain that treatment with the ultra short waves will entirely oust diathermy from the medical field in the near future and acceptance of its therapeutic value may be judged by the fact that several firms are producing short wave apparatus in this country and that machines are imported in large numbers from abroad.

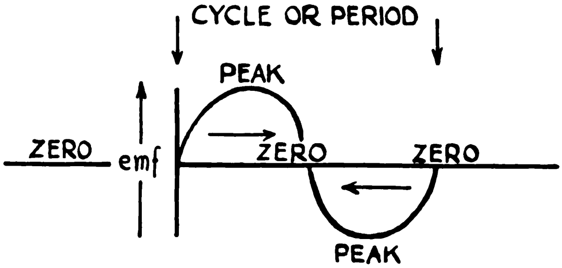
Physical Considerations.

The average medical man has but little time in which to study the rather difficult technical side of such a subject, nevertheless an appreciation of the physical aspect is necessary to a clear understanding of the therapeutics. An attempt will be made under this heading to explain simply why this treatment is called short wave therapy and to show the relationship that exists between this treatment, medical high frequency, and diathermy.

It is first necessary to consider briefly the characteristics of the alternating current.

An alternating current is one which rises from zero to peak potential,

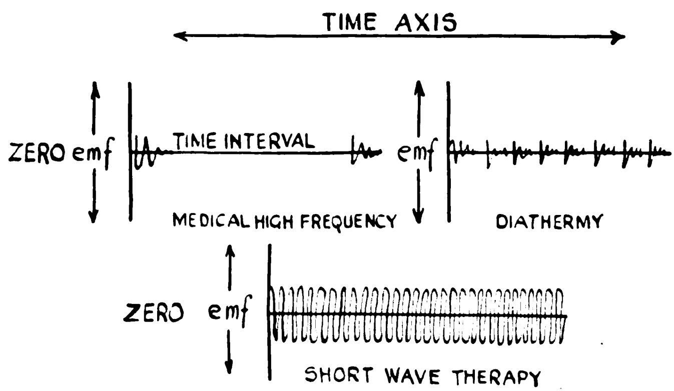
then falls to zero, to be followed by a similar current in the reverse direction. This can be shown graphically as follows:—



Arrows indicate direction of current.

When passed through the living tissues this current has the power to stimulate muscles and nerves, resulting in muscular contraction and sensory stimulation—*providing the rate of alternation does not exceed a certain value.* When alternating with a rapidity greater than 30,000 per second, all power to stimulate muscles and nerves is lost, the current being now termed a high frequency current. There is still, however, a conversion of electrical energy in the tissues and this results in the production of heat through the path of the current.

For comparison of high frequency currents it is necessary to take into account whether or not the voltage (e.m.f.) is maintained and whether or not the oscillations are continuous. When voltage drops over a group of oscillations the current is said to be DAMPED. When the oscillations occur in groups with a rest interval between, they are said to be UNSUSTAINED. From this it will be readily seen that an UNDAMPED but SUSTAINED high frequency current will have the greatest energy in a given time, other factors being equal. The following graphs illustrate this point:—



NOTE.—The correct relationship with time and amplitude is not shown.

4

Medical High Frequency.—Damped and unsustained. The little heat generated is rapidly dissipated before the next group of oscillations occurs and so this current is useless for heating the tissues.

Diathermy.—Damped but relatively sustained. This accounts for heating powers of this current. The heat does not have time to dissipate between groups of oscillations and is continually superadded, the limit being set chiefly by convection losses due to the circulating fluids in the tissues. A good apparatus has a current oscillating as rapidly as one million times per second.

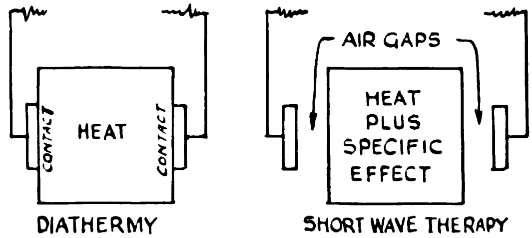
Short Wave Therapy.—(Undamped and sustained). The oscillations vary from 10 to a 100 million per second.

The number of oscillations per second or FREQUENCY has a definite relationship with WAVE-LENGTH. The waves set up by the oscillations travel with the speed of light, about 300 million metres per second. To determine the wave-length the frequency is divided into this figure and to determine the frequency the wave-length is divided into this figure. Thus a diathermy current with an oscillatory factor of one million per second has a wave-length of 300 metres. Short wave therapy with a frequency of 50 millions per second has a wave-length of 6 metres. Hence the reason for short wave as opposed to long wave (diathermy) therapy.

Many users of short wave apparatus still consider that this form of energy is a sort of super-diathermy. Although there are certain physical characteristics common to both forms of energy it should be realized that diathermy and short wave therapy are fundamentally different.

In diathermy the electrodes are applied directly to the surface and thus there is a conduction current which has the sole effect of heating the tissues through which it flows.

In short wave therapy an air gap is maintained between the electrodes and the skin surface, and the energy is transmitted across the gap as a condition of ether stress, obviously not as a conduction current. In addition to heat being generated in the path of this energy there are other changes which form the so-called specific effect, and of this there is abundant clinical evidence but, so far, incomplete theoretical explanation.



There are many observers who refuse to believe in a specific effect, preferring to attribute all of the short wave effects to heat until a specific

effect is proved. No observer doubts the difference in effect of Röntgen rays and ultra-violet rays, although the only physical difference is in the wave-length. The specific effect should be accepted pending the absolute proof which only research can bring.

THE SHORT WAVE APPARATUS.

Some time ago the daily newspapers published accounts of a new treatment given in Germany by means of "wireless," the implication being that the time was not far distant when the patient would sit at home and in some occult manner receive treatment over the ether! Although obvious journalese there was an element of truth in this statement.

The short wave apparatus is a transmitter of energy and the energy involves a wave motion of the ether—in most machines this wave-length being fixed at 6 metres as being the most useful for therapeutic purposes.

An analogy may be drawn between the radio transmitter and the radio receiver in the home, the short wave apparatus and the patient. In both cases there is a transmission and reception of energy. In both instances delicate tuning is a necessity; the radio receiver must be carefully tuned in so as to get the required transmitting station, the patient must be "tuned" in to get the maximum effect from the energy transmission of the short wave apparatus. When the patient is in tune in this way he is said to be in RESONANCE and the importance of this will be made apparent when dealing with the effects on the tissues.

EFFECTS OF SHORT WAVE THERAPY.

It is not surprising that in this comparatively new field of research views should conflict and that the results of one observer should be negatived by another observer in many instances. There is, however, a fairly general agreement that there are two major effects, the heating effect and the specific effect.

The Heating Effect.—All observers agree that there is a penetrating and homogeneous heating of the tissues through which the energy is directed, and that this results in prolonged dilatation of capillaries with increased leucocytosis and phagocytosis.

The Specific Effect.—Evidence as to this is conflicting; not so much that it does occur, but *how* it occurs. It has been shown experimentally that the oscillations bring about a pounding action on the tissue ions. This has been made to break up blood corpuscles, to destroy micro-organisms and to rupture tissue cells, *all without the addition of heat.* It has also been shown that this vibratory effect is greatest where viscosity is greatest (viscosity the opposition to change in molecular position) as in bone, fat, scar and other fibrous tissue. For details of experimental findings after research on animal and human tissues, micro-organisms, on sympa-

thetic and parasympathetic balance, changes in blood chemistry, etc., the reader is referred to the experimental section of Schliephake's "Short Wave Therapy."

In a further article it is hoped to present briefly the views of leading writers on the therapeutic field and a summary of results obtained at the Royal Victoria Hospital, Netley, with case notes where these are of more than ordinary interest.

A WARNING: DISSEMINATED FOCAL PNEUMONIA.

By Major F. J. O'MEARA,
Royal Army Medical Corps.

Para. 522: Regulations for the Medical Services of the Army, 1932, amended by Army Order, April, 1936, reads: "Pulmonary Tuberculosis.—In order that soldiers suffering from tubercle of the lung may be afforded the earliest possible opportunity of obtaining suitable treatment, they will be discharged from the Army as soon as the diagnosis has become reasonably certain. In the presence of combined clinical and radiological evidence indicative of pulmonary tuberculosis, diagnosis will not be delayed merely because the presence of the causative organism has not been demonstrated." The wisdom of the wording "in the presence of combined clinical and radiological evidence of pulmonary tuberculosis" was well demonstrated in the two cases here reported.

A Gunner arrived in Meerut from England at the beginning of March, 1937. He felt ill on arrival in Meerut and reported sick two days later; he was admitted to hospital. In spite of rest in bed his fever increased and his illness progressed, signs of involvement of the left lung developed, and a few days later there was dullness and relative absence of breath sounds below the left clavicle; a few râles were present over this area. A radiogram of his thorax was now taken, the provisional diagnosis of influenzal pneumonia having been made. The radiologist reported that extensive mottling in the upper lobe of the left lung was present and made a very definite diagnosis of tubercular infiltration. In the opinion that the radiogram was a picture of tuberculosis I concurred. The clinical picture of pulmonary tuberculosis was not, however, present. The sputum was examined eighteen times for tubercle bacilli with negative results. The end of the Trooping Season was now approaching and this circumstance forced a diagnosis of tuberculosis pulmonary (clinical) to enable the patient to be invalided to England before the onset of the hot weather. Two days before he left Meerut for England a second radiogram was taken. All evidence of infiltration in the lungs had disappeared. In this opinion

the radiologist concurred. The patient was well, afebrile and up. He had been informed when diagnosed tuberculosis pulmonary (clinical), to permit his invaliding to England, that in all probability no disease would be demonstrated in his chest on arrival there, and that he would be returned to duty.

The solution to this problem was contained in the pages of the *British Medical Journal*, No. 4010, p. 956, dated November 13, 1937. J. G. Scadding described four cases of a condition he terms disseminated focal pneumonia. The two cases recorded in this article differed in no particular from the four cases so described.

The second case involved another radiologist in the same error: a diagnosis of pulmonary tuberculosis from a radiogram, without reference to the clinical features of the case.

In January, 1938, I was requested to see an Indian recruit in the Indian Military Hospital, Meerut. He had been ill for two weeks. His sputum was muco-purulent, fairly profuse and had been negative for tubercle bacilli at a routine examination every day. It remained negative for tubercle bacilli during his illness. He had had a radiogram of his chest taken before I saw him and the radiologist had reported extensive lung infiltration involving both upper lobes, pulmonary tuberculosis. The medical officer in charge of the ward did not consider the patient to be tubercular. At my examination of the patient there was dullness over both upper lobes below the clavicles and in the apices of both axillæ. Fine râles were present over the upper lobe of the right lung at the back. Vocal fremitus and resonance were diminished over the upper lobes of both lungs. I concurred in the opinion of the medical officer in charge of the ward that the condition was not pulmonary tuberculosis. It was suggested that the patient's discharge from the Army be delayed for a month. At the end of that period a further radiogram of his chest was to be taken and permission was granted for me to see him again when his second radiogram would be available. At the end of that period he was afebrile, up, in good health and gaining weight. Clinical examination did not show any abnormal physical signs in his chest and the radiogram was negative for evidence of lung infiltration. In this opinion the radiologist concurred. The patient was discharged from hospital to continue his military training.

These cases are published as a warning against a precipitate diagnosis of pulmonary tuberculosis when a radiogram and not the patient is viewed.

Scadding gives the following points of difference between disseminated focal pneumonia and pulmonary tuberculosis.

(1) The pyrexia increases although the patient is at rest in bed.

(2) The quantity of purulent sputum increases within a few weeks from the onset of the illness.

(3) The continued absence of tubercle bacilli from the purulent sputum.

(4) The radiogram shows a mottling coarser than that found in pulmonary tuberculosis.

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A CASE OF MENINGOCOCCAL MENINGITIS TREATED WITH SOLUSEPTASINE, SULPHONAMIDE AND SERUM.

By MAJOR R. A. BENNETT, M.D., M.R.C.P.Edin.
Royal Army Medical Corps.

THE patient, a trooper in a cavalry regiment, was admitted to hospital on June 26, 1938, with symptoms of meningitis.

The next morning he became gravely ill, his cerebrospinal fluid contained 35,600 polynuclear cells per cubic millimetre, and Group I meningococci were grown in pure culture.

He was given 30 cubic centimetres of soluseptasine intravenously; and 1 gramme of sulphonamide by mouth three times a day. In addition 10 cubic centimetres of anti-meningococcal serum were injected intrathecally. The following morning, the patient's temperature was normal, and his condition had markedly improved.

Twenty cubic centimetres of soluseptasine were given intravenously for the following three days, and the sulphonamide by the mouth was continued. In addition, two intramuscular injections of serum were given. The dose of sulphonamide was reduced by half on the fifth day, and stopped on the eighth day.

The patient's rapid recovery from such a severe attack was dramatic, and, although he became very cyanosed, convalescence was uninterrupted except for a very mild arthritis of the left knee.

I feel convinced that the soluseptasine and sulphonamide were mainly responsible for such a dramatic improvement in the patient's condition.

I am indebted to Lieutenant-Colonel J. Higgins, R.A.M.C., commanding the Military Hospital, York, for permission to send this note for publication.

Travel.

FROM ROME TO KARACHI BY AIR.

By Colonel K. COMYN.

I was on short leave ex-India—with only six weeks in England. It was May and a gloriously fine English spring, and I had to be back at duty in Meerut on May 20. I decided to stay in England to the last moment and return to India as quickly as possible compatible with comfort. I considered the best way would be to go by rail to Rome and thence fly by Imperial Airways. It may be thought why not go all the way by air from Southampton? There were two reasons in my mind—one, that although I had been in the air many times, the longest flight I had ever undertaken was from Croydon to Paris in 1920—and from my recollection of that flight I came to the conclusion that flying all the way from Southampton to Karachi might end in boredom and fatigue with the trip before I arrived at my destination. The second reason was that by going by rail to Rome I saved a few pounds—perhaps not sufficient to be worthy of much consideration. The time factor was of small consideration, being thirty hours or so longer by the rail to Rome route than by rail to Southampton thence by air.

I left London at 9 a.m. on Friday, May 13—to those who are superstitious an inauspicious day!—arrived Paris, Gare de Nord, at 16.00 hours—drove straight to the Gare de Lyons and caught the Rome train leaving there at 17.30 hours, travelling ordinary second class. This was quite comfortable. I arrived at Rome at 18.00 hours on Saturday, May 14, and spent the night in Rome. On Sunday morning a visit to the air agent of the Imperial Airways in Piazza "Dell' Esedra," soon had everything arranged. My baggage was very perfunctorily weighed and then put into a comfortable limousine car. The weight of baggage allowed by Imperial Airways is 221 pounds including one's personal weight—I had with some difficulty reduced my total weight of self and baggage to 234 pounds but no notice was taken of the few pounds overweight.

I left the agency office, the sole passenger in the car, at 12 noon for Lago di Bracciano, about twenty miles from Rome, the landing place for Imperial Airways flying boats. This lake is very picturesque and beautiful on a fine day, several miles in length and breadth and surrounded by low hills. I was told by the local inhabitants that it was very cold and desolate and frequently very wild in winter time. There is a small hotel, very rough and ready, at which one can obtain lunch or simple refreshments. I was met by an Imperial Airways officer of the ground organization staff, who took over my baggage and informed me the plane might be

late. Much to my disappointment he told me I must hand over my camera to be sealed and kept in bond for the part of the journey over Italy and the Mediterranean, as photography of any kind was not allowed anywhere between Lago di Bracciano and Alexandria. This, I think, is an Italian restriction agreed to by the British authorities with regard to the Eastern Mediterranean. The flying boat " Ceres " was due at Bracciano at about 13.00 hours—it did not arrive till about 16.00 hours—three hours late. The west bound craft from Brindisi arrived at almost the same moment and both landed at about 100 yards or so from the small jetty within a few minutes of each other, an impressive sight. The local organization was all ready and immediately a launch with the Customs, passport and police officials with the local Imperial Airways officer put out to the flying boats. The motor barge loaded with petrol also put out. Embarkation of passenger and baggage, inspection of all other passenger passports, and refuelling took under half an hour—and the " Ceres " took the air again at 16.30 hours for Brindisi. The arrival of the plane three hours late at Bracciano was not a good augury for the rest of the journey. However, I soon found out from the other passengers the reason of the delay. The weather over France had been so bad that the Captain had decided to fly right round the west coast of France via St. Nazaire instead of by the direct route across the Continent to Marseilles. I also heard that the trip from the English Channel to Marseilles had been a very bad one—the weather being heavy with low cloud, strong winds and rain necessitated low flying below the cloud and consequently very bad " bumping "—most of the passengers had been air-sick and had a very unpleasant trip. I was pleased I had decided to train to Rome.

We took off from Bracciano in perfect weather though later than schedule.

There were at this stage five other passengers; all had come from Southampton. A Frenchman who was going all the way to Karachi, thence to the Khyber Pass, on business connected with some cement-making machinery; an Anglican bishop going to Alexandria, thence on to the Sudan: a lady who was going to Tiberias, there to be met by her husband for a short holiday, and then to Bahrein where he was employed in an oil company there. The other two passengers were both Imperial Airways officers, one a pilot going to Bangkok to take over duty there, and the other an engineer who was due to go to Karachi.

The crew consisted of the Captain who is chief pilot, the first officer who is second pilot, the wireless officer, the flight clerk who deals with the mail, passenger tickets, passports, etc., corresponding roughly to a purser in a ship, and lastly the steward who supervises passengers' and crews' food on board. The whole crew is changed every two days on the trip, thus the crew from Southampton is changed at Alexandria and the

crew from Alexandria at Karachi. Each crew has two days rest before taking on another flying boat.

The flying boat "Ceres" was one of the fleet of twenty-eight at that time in use by Imperial Airways. It is fitted with four engines, and is capable of a maximum speed of 200 miles an hour. The total weight with passengers and load is over 18 tons. The maximum permissible load is 3,500 kilogrammes (about 3½ tons) which may be passengers or mail. The seating accommodation appeared to be for twenty-eight passengers, but several seats had been dismantled to make more space, and owing to the great increase in mail now carried, the number of passengers actually taken is less and varies with the amount of mail.

The inside is extremely comfortable. The seats consist of very well upholstered lounge chairs with metal frames, the angle of which can be easily adjusted by levers operated by the passenger as he sits in the seat. The position thus can be varied from an upright sitting position to a low recumbent one. These seats are in pairs on one side of the cabin and single on the other side, with a gangway between the sides. Thus two out of each three seats are actually beside a window. Each seat has a folding table in front of it, and is also provided with a rug for cold weather. Above is a tube ventilator which can be controlled from the seat, connecting with a warming and cooling system from the engine-room, providing warm air for cold weather and cold air for hot.

The front portion of the fuselage, and the extreme tail end are set apart for baggage and/or mail, with doors which can be locked. Next behind the forward baggage portion is the main entrance, with a door on either side. In this part of the body the flight clerk has his table, cupboard, etc., constituting a small office.

Between this and the main passengers' accommodation is a passage on one side of which is the steward's pantry, wash-up, etc., and on the other side two lavatories. Behind this passage is the main passengers' saloon or cabin, divided into two compartments. These compartments are more or less similar, but the passengers are permitted to smoke in the rear compartment but not in the forward one.

Before starting my journey I must admit to feeling qualms of nervousness as to how it would feel in a crash to be shut inside the plane and unable to get out. However I was soon relieved to observe that there are two emergency though narrow exits in the roof with ladders leading up to them—also every window can be kicked or punched open if necessary; they are specially constructed with this purpose in view. There are, in addition, three ordinary doorways. Thus one should never be trapped inside in the event of an emergency provided one is capable of moving. Certain meals are provided on board and others at hotels at the stopping-places. The meals provided on board are excellent, though facilities are

very limited. All food has to be put on at the previous landing-place in thermos flasks. There is no means of heating food or water on board, not even of boiling a kettle—a prevention against danger of fire, of course —even all hot water for washing-up purposes has to be put on in flasks. But in spite of these difficulties meals were excellent. Here is one dinner menu—hot soup, Sea of Galilee fish, grilled steak and vegetables, custard ice; and a breakfast—grape fruit, bacon and scrambled eggs, rolls and marmalade or jam, tea or coffee. Drinks can be obtained from the Steward at any time by those who want them.

After the first fifteen minutes or so in the air, one does not realize that one is flying. The noise is remarkably slight considering the four powerful engines. This is one of the greatest improvements since the early days of flying to Paris in 1920. Conversation can be quite easily and comfortably maintained in the cabin. In 1920 this was quite impossible. The idea of speed or movement is quite lost as soon as one is 500 feet or so up. Although averaging 150 to 170 miles per hour everything below looks stationary with an extraordinary atmosphere of peace. It is only when near the ground or taking off or landing that the speed is realized and everything appears to be racing past.

The landing speed of these machines is about seventy miles per hour, and with a weight of 18 tons, one realizes that the slightest error of judgment of height or in flattening out too soon or too late on the part of the pilot may be disastrous. The wings are fitted with a device to lessen the landing speed and diminish the risk of stalling if the speed falls too low on approaching or taking off. This device consists of mechanism whereby the rear section of the wing is mechanically tilted in relation to the rest of the wing, having the double effect of increasing the lift on the forepart of the plane and acting as a brake by increasing the wind resistance.

Leaving Lago di Bracciano we quickly rose to about 1,000 feet— we soon passed over the river Tiber, leaving Rome to the south. One could now see why the Tiber was always referred to in the Latin classics as the yellow Tiber. There was almost an ochre tinge about its putty coloured appearance from the air. We then headed for the Sabine Hills east of Rome, taking the shortest route to Brindisi. The plane was nearly three hours late at Bracciano and there was no possibility of making up this time before night. We could not expect to reach Brindisi, 314 miles, much before sunset. As we approached the Sabine Hills we ran into stormy weather and our Captain decided to climb over the storm clouds to avoid head winds. We steadily climbed above the clouds until we reached about 16,000 feet and the ground was quite lost below the cloud bank. At this altitude it became very cold, the windows became coated on the inside with moisture, which soon froze to solid ice. Our rugs became very

necessary. This was the only time during the whole period of flying that I felt any discomfort, not from air sickness, but from the altitude. It was a feeling of restlessness or shortness of breath, a feeling that I was not anxious to go any higher. It did not last more than five minutes and one soon got adjusted to the height. 12,000 feet or so is high enough for most landsmen to climb up to so rapidly. We soon passed over the Sabine Hills and the storm clouds, and coming down to about 2,000 feet, the Italian country towards the East coast appeared very peaceful and sunny. The coast was soon visible and our route took us parallel with it to Brindisi. A perfect landing was made in the harbour at about 18.15 hours. All the passengers were taken ashore in a motor boat, passports were examined

"Ceres." Moonlight on the Shatt-al-Arab.

and the flying boat refuelled. Cups of tea were given us at the examination shed. Subsequently I heard that a rapid consultation was held between the officers of the "Ceres" and those of the Imperial Airways ground staff as to the advisability of continuing to Athens, the next lap, that night. On receipt of good weather reports it was decided to do so, but the Imperial Airways engineer, who was travelling as a passenger, was, much to his disappointment, left behind at Brindisi owing to our total weight being, with him, more than our Captain was prepared to carry on a night flight over the route to Athens, some parts of this route passing over mountain ranges or through somewhat narrow passes between them. We took off just as the sun set, heading straight out to sea in the direction

of Corfu across the straits of Otranto. As the coast of Italy faded, so did darkness set in. For nearly an hour we were flying in what appeared, from the passengers' cabin, complete darkness: one could see nothing below, above or on either side. Then we began to approach groups of islands in the Ionian sea off the coast of Greece, but all we could see were the navigation lights on the various headlands. Leaving the island of Cephalonia to the south we approached the Gulf of Patras, between the Peloponnese and the mainland of Greece. By this time a full moon had risen in a perfectly clear sky and as it gradually rose above the Eastern horizon it showed up the mountain ranges in silhouette on each side and lit up the sea below us. Proceeding up the Gulf of Patros and then the Gulf of Corinth, flying now fairly low, probably less than 1,000 feet, the scenery was beautiful in the extreme; on either shore here and there were towns and hamlets lit up by electric light, the bigger towns showed distinctly water fronts and quays with the town steeply sloped away from the front towards the mountain behind.

Flying over the Isthmus of Corinth and then the Saronic gulf with the Peloponnese to the west and Attica to the east we soon arrived at the Port of Athens, 369 miles from Brindisi, at about 21.30 hours. Here we stayed the night. After the usual customs and passport inspection, which did not take long, our baggage was sorted, such as we required for the night being packed into a large autobus, the remainder being left in the Imperial Airways shed. We drove into the city of Athens to the Hotel Grand Bretagne. Here after a bath an excellent dinner was served at 22.15 hours. This hotel is one of the most up-to-date I have been in, each bedroom being equipped with a splendid bathroom, and modern furniture, extensive cupboards built into the wall, etc. Our night here was a short one for we were called at 04.15 hours, a light breakfast of tea and rolls at 05.00 hours and left the hotel again by autobus at 05.30 hours. We were soon aboard the "Ceres" again and took off at 06.00 hours, just as the sun was rising above the horizon. Soon after we left Athens we were over open sea and left land behind us. We were supplied with a good breakfast on board and the weather was good. At about 08.30 hours the steward came through and said we had better adjust our safety belts as we were approaching Crete and it might be "bumpy" there. Each seat has a safety strap belt which one can adjust quickly and which secures one firmly in the seat. As we flew over a belt of land between mountain ranges in Crete we met sudden gusts of headwind creating air pockets and various air currents. I was very glad to experience this for without such experience one could never believe it possible that a machine weighing 18 tons could be thrown about in the air, up, down and sideways, just as a cork is flung about on a whirlpool of water. This, however, did not last long, ten or fifteen minutes later we came down and landed in Mirabella

Bay, Crete. Here the sea was very choppy and landing and taking off were decidedly exciting. We took off after refuelling, a matter of thirty minutes, and again had considerable bumping until we were clear of Crete. From here to Alexandria was one of the most beautiful periods of the journey. The weather was perfect, the sky clear, the sea looking as blue as only the Eastern Mediterranean can look when calm—we were flying at about 2,000 feet and with no appreciable movement, the machine was so steady. Presently we met thin fleecy white clouds over which we passed with glimpses of blue sea through the gaps. At that height with nothing but sea and sky it is difficult to realize one is moving; on the contrary one has the illusion that one is stationary and the sea below, like a sheet of blue Venetian glass, fluted into minute ridges, is slowly moving. It is one of the most beautiful sights, this combination of brilliant sapphire blue sea below and the silvery fleecy clouds reflecting the sun upwards making them look like pure white cotton wool. Far below us from time to time could be seen our shadow just like a tiny hornet, now on the surface of the sea, now showing up more darkly on the white cloud. Soon, however, we were to say good-bye to this beautiful scene. As we approached Alexandria and the Egyptian coast the sea assumed a leaden hue due mainly to the silt coming down from the Nile and also the backwash from the shore belt.

(To be continued.)

Current Literature.

CROWDEN, Dr. G. P., and ANGUS, T. C. **The Control of Indoor Environment by Air Conditioning with special reference to the Tropics.** *Journal of Institute of Heating and Ventilating Engineers.*

A long paper of considerable interest to Europeans in the tropics, based on a detailed lecture given at the London School of Hygiene and Tropical Medicine.

Advances in studies on air-conditioning are rapidly making possible attainment of indoor environment compatible with comfort irrespective of outdoor conditions. The physical ability to maintain body temperature at a practical constant is well known; but not so well known is the mechanism to face wide variations, or the extent to which control and thermal comfort are influenced by external factors. With only slight variations the human body produces 400 B.Th.U. cf heat per hour when resting, rising to five or six times more at heavy work.

But seeing that body temperature remains constant there must be heat transference to and from solid surroundings.

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But seeing that body temperature remains constant there must be heat transference to and from solid surroundings.

In viewing the problem the following points should be noted :—

(*a*) The bodily power of maintaining constant temperature.

(*b*) The bodily production of 400 B.Th.U. per hour irrespective of environment.

(*c*) The skin temperatures can be partly controlled by alterations of blood-flow.

(*d*) The skin conductivity can be altered by sweating; 585 gramme calories are absorbed per gramme of water evaporated.

(*e*) The skin surface acts as a black body.

(*f*) The variations in protection by clothing, particularly that worn indoors.

Apart from clothing, thermal comfort depends on physical characters; air temperature, humidity and movement, and on radiation from solid surrounds. Indoor environment can be controlled, but radiation is not readily controlled unless the nature of the construction of the surroundings ensures rapid response to desired changes and accurate appraisal of their qualities. This applies particularly in the tropics.

The comfortably clothed subject in still air of 50 per cent humidity and a wall temperature of 50° F. loses body heat to his surroundings by radiation 46 per cent, convection 30 per cent, and evaporation 24 per cent. But at 74° F., even from the unclothed body, heat loss by radiation is reduced by half.

Where hot climates make radiation impossible air conditioning is requisite for rest and sleep.

Differences of surroundings will produce unequal radiation; a cold window will double the heat loss on that side. In a class of boys in rows at two-feet intervals and one foot between the boys radiation is reduced by 35 per cent.

Drinker showed that a definite factor must be added for radiation in correcting air temperatures to a comfort zone in cold climates. An individual will base his opinion on personal sense of comfort irrespective of recorded temperature or humidity.

Data for tropical conditions are lacking and charts which include thermal sensations of a number of experienced observers are needed.

It is generally accepted that surface temperatures of surrounding solids should differ little from the dry bulb temperature of the air comfort level particularly in the tropics. The uses of metallic insulation for this purpose have already been reported.

Black from Singapore suggested air-cooled cubicles for bedrooms for Europeans, who decline progressively in physical and mental vigour, entailing general leave allowances and fixed limits to the periods which can be served in the tropics.

The problem appears to be one of being able to control the radiation

factor by means of air from a small room unit and for this purpose the question of materials becomes of importance.

Dufton showed that the thermal capacity of materials at the heated surface largely determines the rate of warming as shown by a panelled and unpanelled room. A reduction in the heating or cooling load in intermittent conditioning can be secured by provision of internal surfaces of low thermal capacity. This can be further improved by spacing the surface lining away from the main structure of the walls, floors or ceiling, and still better by interposition of a metallic diaphragm of aluminium foil on a card base.

Air conditioned cubicles for use in the tropics constructed on the lines indicated were devised and subjected to tests. To keep equilibrium at a given range which has been considered to be suitable, the capacity of the cooling plant has to be determined to ensure economy. It is therefore necessary to make close estimation of both sensible heat and latent heat entering the enclosure and that produced or released in it.

A small cubicle containing bed, chair and table, providing a restful night was envisaged; the small size being chosen for economy in cost and maintenance. A cubicle 9 by 6½ by 7 feet was erected in the air conditioning chamber of the School and subjected to tropical conditions. The cubicle was made of panels of light angle iron frames holding asbestos boards with a central aluminium foil diaphragm. Cooling loads required for 15 degrees reduction were determined by ice melting trials.

Subsequently, a model cubicle capable of commercial production was designed and tested out. It had panelled walls of thin bakelite boards with central diaphragm of aluminium foil, built in sections which can be clamped together, size 10 by 7 feet 1 inch by 6 feet 2 inches high. The overall cooling loads required for specific external conditions were calculated (calculations are shown in full in the text) and the cooling load, B.Th.U. per hour required by the cubicle when containing two men was also calculated and set out.

As humidity and temperature were to be maintained by dried cooled air, calculations were required to ascertain quantities for this purpose; by the graphical method this was shown to be 70 cubic feet per minute with D.B. 73° and W.B. 69° F. giving R.H. of 81. In addition air for ventilation was calculated and the extra heat involved estimated.

All calculations were rechecked. It was found that the totals of sensible and latent heat compared well with estimated values.

Methods of automatic control were tried and a human hair humidostat was favoured, but this point needs further work.

Finally it was found that air movement by means of a table fan was essential to relieve sensation of stagnation.

The actual trials showed that it is quite possible to provide an indoor

environment which would be welcomed by European residents in the tropics.

The subsequent discussions criticized the authors' remarks on the thermal capacity of materials, pointed out the advantages of freedom from insects, the unsuitability of this method for numbers of persons, particularly of military personnel, and the need for such cubicles in hospital practice.

Reviews.

TREATMENT IN GENERAL PRACTICE: THE MANAGEMENT OF SOME MAJOR MEDICAL DISORDERS. Vol. I. Second Edition. By various authors. 1938. Pp. x + 254. London: H. K. Lewis and Co., Ltd. Price 8s. 6d. net.

This little work which was first published in 1936, consists of a collection of articles which appeared at intervals in the *British Medical Journal.* The edition soon became exhausted and a necessary reprint appeared in 1937. This evidence of popularity makes it certain that the present edition thoroughly revised and brought up to date will be in great demand, inasmuch as the articles cover a very important field of general practice, including as they do chapters on pneumonia, bronchiectasis, specific fevers and an all-important selection of short monographs on cardiovascular disorders such as carditis, coronary thrombosis, angina and thyrotoxicosis.

The authors of the various chapters have been well chosen and the busy practitioner will welcome the concise descriptions of the ætiology, main symptoms and main lines of treatment. The somewhat dogmatic opinions will be counterbalanced by the rapidity with which the reader will obtain not only the information he requires but also the immediate benefit of the authors' wisdom and experience. The subject matter is set out in a thoroughly practical manner and with every confidence it can be said that the book is of great value and one that has already established its place in the world of medical textbooks. To the very critically minded the representation of the doses of drugs should be in accordance with the British Pharmacopœia of 1932. The book is of convenient size, the type is clear and the index is adequate. R. P.

REPORT OF THE JOINT TUBERCULOSIS COUNCIL: THE DEMONSTRATION OF TUBERCLE BACILLI IN SPUTUM. Printed by the British Legion Press, Preston Hall Industries Incorporated, near Maidstone, Kent.

This is the most recent report of the Joint Tuberculosis Council on sputum examination, and gives methods, relevant data and advice for the practical guidance of medical officers of the tuberculosis services.

The report is divided into seven parts and, in addition, there is a bibliography and an appendix; the whole booklet consisting of forty-eight pages.

Part I is concerned with a detailed description of the technique used in the demonstration of the organism by the microscope, and concludes with a comparison of the various methods which have been advocated.

Part II deals with the demonstration of the organism by culture and discusses clearly the various methods which may be employed.

Demonstration by animal inoculation is dealt with in Part III, and Part IV, which is perhaps the most instructive section of the report, compares the efficiency of the three methods.

Clinical routine, sources of errors and gastric lavage are described in the remaining parts of the report.

The Appendix contains much useful data, and, in addition, unpublished results obtained independently by the individual writers of the report or by their assistants.

This is a valuable report and every military laboratory should be in possession of a copy.

THE FOOT. By Norman C. Lake, M.D., M.S., D.Sc.Lond., F.R.C.S.Eng. Second Edition. 1938. Pp. viii + 366. London: Baillière, Tindall and Cox. Price 12s.

Mr. Lake is to be congratulated on the second edition of his most complete and interesting study of the foot. It is a most comprehensive study and well illustrated. The author has not hesitated to make use of references from other authorities, but loses nothing of his individuality in doing so, and at all times maintains a well-reasoned sense of proportion in argument on contentious subjects.

I can strongly recommend this work to all medical officers, for we are so often faced by "foot problems," and too often simple cases are referred to a specialist for opinion. The book should be in every military hospital library.

D. C. M.

TEXTBOOK OF CLINICAL PATHOLOGY. Edited by Roy R. Kracke. 1938. Pp. xvi + 567. London: Baillière, Tindall and Cox. Price 27s. net.

In collaboration with eleven teachers from the medical schools in the Southern States of the U.S.A., Professor Kracke has produced this textbook. With a subject like clinical pathology, which covers such a wide field, it is difficult for one individual to deal extensively with all its ramifications, and this form of authorship is to be commended.

The volume is not a book of laboratory technique, and when used in our military laboratories would require to be supplemented by reference to works which deal with the subject in greater detail. It is, however,

a volume which the students of medicine and the practising physician will find of value when studying the interpretation of laboratory findings; in this respect the work is a useful addition to the textbooks dealing with this aspect of the subject. It is more important for the general practitioner to be able to interpret laboratory reports than it is for him to have a knowledge of highly technical procedure involved in many laboratory tests.

The subject matter is clearly expressed and the book extremely well illustrated.

MODERN ANÆSTHETIC PRACTICE. Edited by Sir Humphry Rolleston, Bt., G.C.V.O., K.C.B., M.D., F.R.C.P., and Alan M. Moncrieff, M.D., F.R.C.P., with an Introduction by J. Bloomfield, C.B.E., M.D. "The Practitioner" Handbooks. 1938. Pp. 231. London: Eyre and Spottiswoode, Ltd. Price 10s. 6d.

The contributors to this volume have managed to condense into twelve short chapters a consideration of the theoretical aspects of anæsthesia and a practical summary of the modern practice covering all the branches in general use. The articles are essentially practical and the whole book abounds in useful hints and tips. The only regret is that some of the chapters, particularly that on Spinal Anæsthesia, are not as long as we could wish and do not give enough detail.

It is a book that should be read by all medical officers who may at any time be required to give an anæsthetic. G. D. G.

Correspondence.

MECHANIZATION AS IT AFFECTS THE MEDICAL SERVICES.

TO THE EDITOR OF "THE JOURNAL OF THE ROYAL ARMY MEDICAL CORPS."

SIR,—To me the articles and letters on this subject appearing lately in the Journal are most interesting. As Colonel Atkins says, mechanization produces the following factors:—

(i) Units may be employed on a wide front.
(ii) The range of action of a unit is increased.
(iii) Manœuvre will be more rapid.
(iv) One or more units may be separated from the main force.
(v) A raid into enemy country may take place.

In other words, mechanization of a force should mean mobility.

The following are a few random jottings, based on discussions on this subject with many officers, combatant and medical, which may lead to further mobility of the medical entities and units of a mechanised force.

(1) As the modern mechanized force is built for speed and so may get

away from its administrative services the first essential is the training of a high percentage of each unit of the force in first aid (chiefly the stopping of hæmorrhage, and the immediate first-aid treatment of fractures), *vide* K.R. para 800 (c).

In pre-War days the O.C. 14th Hussars insisted on his R.M.O. putting about half of his regiment through the first St. John Ambulance examination (not the usual regimental first-aid class), and making his men sit for the examination.

This standard would appear a necessity now, as mobile vehicles must on occasion carry forward single wounded cases, being unable to drop them at once owing to the nature of their duty.

(2) In addition to the 12-cwt. van or 15-cwt. truck assigned to carry the R.M.O., his orderly and equipment, an 8-cwt. truck should be provided for the R.M.O. (compare the M.O.'s horse in pre-War days), to allow of his independent action and to carry his immediate requirements; the van or truck (corresponding to the Maltese cart of pre-War and "Great" War days), will carry the orderly and the main equipment for the R.A.P. The 8-cwt. truck is a standard pattern, being used by "wireless signal" parties, and is better than the suggested box-car for officers. The van or truck for the equipment should be provided with a fold-up "lean-to" for each side capable of being pulled out from the side, or of quick attachment to the side similar to the "lean-to" of the modern caravan. This will form a comparatively inconspicuous two- or three-roomed R.A.P. which can be quickly opened or closed.

(3) All 30-cwt. lorries and the dental van with field ambulances should be fitted, like the van or truck of the R.M.O., with the fold-up "lean-to" on each side of the caravan type, each lorry forming three rooms of a "Dressing Station."

A lorry of this type is the official "office" lorry, demonstrated at the R.A.M.C. Camp of Instruction at Aldershot this summer, which appeared to work admirably.

The lorries of a field ambulance could be used in the following ways: (*a*) Single lorries could be the basis of a W.W.C.P., if required, or of a decontaminating centre for a dressing station. (*b*) When ambulance cars cannot get right up to the R.A.P.s, single lorries could be pushed up to car-posts, and form a mobile rest room where patients can await cars, or be resuscitated, etc. Compare these with the present four-section lorries of the mechanized Cavalry Field Ambulance. (*c*) The four lorries of a Company, wholly or partially opened out into twelve or less rooms, could form a dressing station. This need not cause the remark of Lieutenant-Colonel Nicholls' Gunner friend, "Gosh, what a target," as such lorries would be suitably "dispersed" and camouflaged. Judicious dispersal is a *sine qua non* of a mechanized force on the move or resting.

(*b*) and (*c*) suggest a means of combining the two types of present

field ambulances; a Company consisting of four small self-contained sections, each of which has duplicate equipment as in the present Cavalry Field Ambulance and is capable of acting singly (as in (*b*)) in mobile actions, or combined (as in (*c*)) to form an A.D.S., if the advance becomes slower or static.

(4) Several of these lorries could be fitted up as travelling dressing stations, somewhat similar to those used in the wilds of the colonies, by adding shelves and divisions, or small cupboards, for boxes containing sterile dressings, containers for antiseptic solutions, and instruments in racks. "Drop-down" or "lift-up" tables might be added; on these patients could be laid, or dressings, etc., placed.

(5) 3-ton lorries should be replaced by 30-cwt. lorries in the Field Ambulance Transport. The former are much slower, much more bulky in narrow roads, and travel half the m.p.g. of a 30-cwt. lorry, an important "supply" consideration.

F.S.R., Vol. II, Section 27 (4), shows that the 30-cwt. lorry carries 15 fully-equipped men, the 5-ton lorry 20 men, so presumably the 3-ton carries about 18 in proportion.

(6) Motor Ambulance Cars (this is the term recommended to be taught to all R.A.M.C. ranks and to combatants, to designate these vehicles) of a light variety, capable of carrying 2 "lying" and 3 sitting cases, or 6 sitting cases, were tried out in Northern India five or more years ago, and again lately in the Waziristan "show" with great success. They were mostly V-8 Fords, but probably a light 6-wheeled chassis of a British type could be provided of equal lightness and balance. They are less conspicuous, more handy, and lighter than the routine 6-wheeler if they break down. In a quick advance a light motor ambulance car could be attached temporarily to each tank battalion.

(7) In mobile warfare, the light ambulance cars work between R.A.P.s (or car posts) and the dressing station, and the heavier ambulance cars with those of the M.A. Convoy evacuate the dressing station formed by the H.Q. of a field ambulance, direct to the C.C.S.

If car posts require to be formed, the section lorries of the company can be sent forward there as recommended in 3 (*b*) above.

(8) In less mobile or static conditions the light ambulance cars work between R.A.P.s (or car posts) to the A.D.S. formed by a company of a field ambulance if required, and the heavy ambulance cars between the A.D.S.s and the M.D.S. formed by the H.Q. of a field ambulance; and the M.A.C. from M.D.S. to C.C.S. as in the present R.A.M.C. training. The necessity for such dressing stations would be determined by country, distances, etc., as usual (*vide* (10) below).

(9) Tents, except the operating tent, or the modified operating tent, as shown at the Aldershot Camp of Instruction, could be deleted from, or

decreased in the ordnance scale of a field ambulance, as the lorries of the H.Q. would form the waiting, dressing and resuscitation rooms and wards, etc., of the M.D.S.

(10) It should be remembered that though the R.A.S.C. have cut out one link of the supply column, as Major Richardson remarks, yet this column may have to work from a railhead for 50 to 75 miles in advance, so the C.C.S. at railhead may rapidly become 50 or more miles in rear, a big argument for the definite motorizing of the whole C.C.S. or its light section, as Lieutenant-Colonel Nicholls mentioned.

Present-day C.C.S.s are slow to open for full duty and equally slow to close, and have no transport of their own by which they can be moved.

(11) Single lorries of the Corps Field Ambulance could form the basis of decontamination centres on the route of the supply column in the Corps Area outside Divisional Areas, using buildings where possible on the route. Medical units deal with their own personnel for simple decontamination, and with "combatant casualties" who require decontamination as well.

The present teaching, which must be brought home to all, is that ordinary decontamination is the immediate responsibility of the man himself, to be dealt with in the first ten minutes after contamination.

(12) Intercommunication remains one of the biggest worries of a Field Ambulance Commander and of an A.D.M.S. Division. Breakdown in this has been the chief cause of the cessation, or slowing up, of evacuation of casualties by field ambulances, so on no account should the motor-cyclist orderlies for intercommunication be reduced in number when the war establishment of a field ambulance comes to be altered.

(13) The reduced man-power of a mechanized force means the probability of a great reduction in the number of casualties to be evacuated, especially as the vehicles are mostly armoured (compare the 2,300 men of the Mechanized Cavalry Division with the 9,200 of the old horsed Cavalry Division).

(14) One of the main methods of preserving mobility is to advance on a wide front, as this allows of turning any strong opposition met with on any part of the front, and also facilitates supply arrangements (F.S.R., Vol. III., Sec. 22 (2)).

This wide front will probably mean each Field Ambulance following up its own Brigade, and possibly needing to be split into a Headquarters and a Company, so it is not agreed that Companies should be completely omitted as suggested by Lieutenant-Colonel Atkins, but the present Cavalry Field Ambulance of a Headquarters and four sections modified; a Headquarters and a Company of four (or three) sections (now that a Brigade is cut down to three battalions) would appear to be a suitable unit.

(15) A percentage of the lorries of combatant units and of R.A.S.C. columns should have the "Berridge" or "Flint" improvised equipment available for slinging two or four stretchers as required. Many lorries on the N.W. Frontier of India had the "Berridge" fitments, which were carried in a small box fixed in the lorry.

It is considered that all the above points will assist in maintaining the mobility of the medical units of the mechanized force as at present organized.

London, I am, etc.,

November 28, 1938. P. S. TOMLINSON,

Colonel.

Notices.

M AND B 693 IN GONOCOCCAL INFECTIONS.

WE have received from Pharmaceutical Specialities (May and Baker) Ltd. a copy of another publication on the addition of M and B 693 to chemotherapy. This is a sixteen-page booklet which is entitled "M and B 693 in Gonococcal Infections."

We understand from the manufacturers that they delayed bringing M and B 693 to the notice of venereologists until they were satisfied that the use of this product marked a real advance in the chemotherapy of that disease. The booklet which they have now produced represents the pooled results of observations in over 1,000 cases.

Copies of this publication are available to medical practitioners on request.

THE ROYAL SANITARY INSTITUTE.

HENRY SAXON SNELL PRIZE.

THE Henry Saxon Snell Prize was founded to encourage improvements in the construction or adaptation of sanitary appliances, and is to be awarded by the Council of the Royal Sanitary Institute at intervals of three years, the funds being provided by the legacy left by the late Henry Saxon Snell (Fellow of the Institute).

The Prize in the year 1939 will consist of Fifty Guineas and a Silver Medal of the Institute, and is offered for an essay describing suggested improvements in the construction or adaptation of sanitary appliances.

Competitors should realize that what is required is constructive suggestions for improvements in sanitary appliances and not merely an account of the developments that have already taken place.

General Conditions.

(1) The essay to consist of not more than 5,000 words, to be type-written on foolscap, one side only, and to be illustrated by drawings or sketches.

(2) Two competitors may combine in sending in an essay and drawings.

(3) Essays must be delivered on or before September 30, 1939, addressed to the Secretary of The Royal Sanitary Institute, 90, Buckingham Palace Road, London, S.W.1.

(4) The essay is to be submitted without the name of the competitor.

(5) The essay to bear a *nom de plume*, legibly marked on the right-hand lower angle of the first sheet.

(6) The essay to be enclosed in an envelope, bearing the words "Henry Saxon Snell Prize," and the competitor's *nom de plume* at the right-hand lower angle, and to be directed to the Secretary of The Royal Sanitary Institute.

(7) The essay to be accompanied by a letter containing the competitor's name and address, which is to be enclosed in a separate envelope, sealed with a blank seal, and having on the outside "The Henry Saxon Snell Prize," and the same *nom de plume* as that attached to the essay submitted.

(8) Should none of the essays be considered of sufficient merit or importance to deserve the prize offered, the Council reserve the right of withholding the award.

(9) In the event of two essays being of equal merit, the prize may be divided.

(10) The essay or essays to which the prize is awarded are to become the property of the Institute.

Should the Council decide to publish the essay or essays to which the prize is awarded, notice will be given to the competitor or competitors in order that patent rights may be secured, if desired, for any of the appliances mentioned in the essay or essays.

(11) The carriage of the essay to and from the office of the Institute, and all expenses incidental thereto, must be paid by the competitor. Unsuccessful essays will be returned on application, on the production of a formal demand within a period to be specified after the close of the competition.

(12) Due care will be taken of all essays, but the Institute will not be responsible for any loss of or damage to them while they remain in its keeping.

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No. 2. February, 1939. Vol. LXXII.

Journal

OF THE

Royal Army Medical Corps

ISSUED MONTHLY

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Price Two Shillings and Sixpence net

VOL. LXXII. FEBRUARY, 1939. No. 2

Journal
of the
Royal Army Medical Corps.

Original Communications.

HEAT STROKE AND ALLIED CONDITIONS.

By LIEUTENANT-COLONEL T. B. NICHOLLS,
Royal Army Medical Corps.

THE problem of preventing heat stroke and its allied conditions in tropical countries has always been one of considerable difficulty, especially on active service. Troops have to carry out their duties, often under the most unfavourable conditions, and the measures of prevention usually taken have frequently been in conflict with purely military considerations. The confinement of troops to their barrack rooms for long hours of boredom must necessarily unfit them for the by no means rare occasions when they might be called out during the height of the hot weather. It is a well-known fact that the men of the Royal Artillery in horsed batteries in India have far fewer cases of heat stroke than the men in the infantry; they work in the stables, thus obtaining a certain amount of exercise, while the infantry are confined to their barrack rooms.

There have been many theories as to the causation of heat stroke; but, until comparatively recently, none of them have explained the conditions, nor, what is more important, have they given us any clue for its prevention. The incidence of the effects of heat may be a very serious matter on active service. The following figures from the campaign in Mesopotamia show the extent of the problem [13].

ADMISSIONS FOR THE EFFECTS OF HEAT. MESOPOTAMIA.

1914-15	77·39 per 1,000
1916	51·00 per 1,000
1917	74·40 per 1,000

6

The writer has always been particularly interested in this subject, and had arrived at certain conclusions set forth some years ago in the following letter written early in 1932. It is printed without alteration and the colloquial tone may be pardoned in a private communication.

SOME REFLECTIONS ON HEAT STROKE.

"Dear ——,

"May not the etiology of heat stroke be the loss of salts rather than the presence of toxins? It is not very obvious where these toxins are elaborated. Most cases recover fairly rapidly when given intravenous saline. May this not be due to the salts in the saline rather than the fluid, as most cases have had plenty of fluid before they succumb? Also, the improvement is apparent long before any toxins could possibly be eliminated. The idea of toxins is very old, but no one when challenged to demonstrate them has been able to do so.

"In iron foundries it is the custom to provide salt and water for those tending the furnaces to drink, and this is also done in the stokeholds of ships in the tropics.

"In the Oorgaum Gold Mine a form of heat exhaustion with abdominal cramps used to be very common. The mine is very deep and the temperature is, I believe, 130° F. or thereby. The men are now given salt and water before descending, and this is also given to visitors. Since this has been done, heat exhaustion has been non-existent.

"My theory is that the troops are made to take too much exercise, owing to the superstition that if you exercise till you drop, you are 'fearfully fit.' The excessive sweating consequent on this reduces the salt content of the serum, and, as the young soldier eats so many sweet cakes, and drinks so much sweet tea, he has no appetite for his dinner, and therefore does not replenish the salt lost during the day.

Last year, in a certain district, there were 40 cases of heat stroke at one station, and only three at mine, one of which had had heat stroke the previous year. The S.M.O. at the former is a real 'He-Man' and is mad on exercise, and the troops had a lot of it. Whereas I, not being superstitious, stopped most of it at my station and we had very few cases, although, being only 60 miles apart, the climatic conditions of the two stations were identical.

"The inhabitants of the country, after centuries of experience, do not take violent exercise in the hot weather.

"Though, in an official communication, one would be very chary of recommending beer in these degenerate days, I think it is a pity that 'Char and Wads' have taken its place. The tea is stewed for hours till it is nothing more than infusum acidi tannici, and the cakes seem to be made of sweetened concrete. This is a most constipating combination, and constipation is the half-way house to heat stroke.

"On the other hand, beer is a gentle laxative, and taken in moderation is, in my opinion, a great help in keeping fit in the hot weather.

"One seldom finds a moderate beer drinker in hospital with heat stroke, though, of course, those who drink it to excess are asking for trouble. Perhaps the 'Canteen Wallah' who used, in the old days, to put salt in the beer, worked better than he knew.

"I think another contributing cause is a too early réveillé. On a blazing hot night no one sleeps restfully till about 3.30 a.m., then the bugle goes at 5.30 a.m. and the men are deprived of an extra hour of restful sleep, and start the day tired.

Yours, etc."

Some time after writing this letter, the writer was posted to Multan, which can safely be described as the hottest station for European troops in India, where for several weeks the maximum shade temperature was 127°F.

The measures outlined above were very successful, no single case occurring among the troops during the whole hot weather. This record, never previously attained in this station, was, however, spoiled by the writer himself falling a victim to heat exhaustion. This unpleasant experience led to a greater interest, and to a desire to learn more of the condition.

On being transferred to the home establishment, every paper on the subject, that I could trace, was consulted. Since many of these sources of information are not readily available, especially to those serving abroad, it is thought that extracts from some of them might be of interest, especially as they lead to new ideas for the prevention of heat stroke.

The most striking discovery made by recent research work is the condition of electrolytic imbalance of the body fluids, due to the loss of salt by sweating, and to the disturbance of the normal water metabolism. This discovery bears out the conclusions, arrived at several years previous to 1932, of the beneficial results of saline administration.

The first paper to be consulted was the article by Lee [1]. The valuable analytical table of the various forms of the effects of heat and their physiological effects should be read by everyone interested in this subject. He gives a possible explanation of the stimulus to work of the heat-regulating mechanism; this may be activated either by stimulation from the heated skin, carried by afferent nerves, or by a very slight increase in the actual temperature of the blood itself. Further study of the paper suggests that the altered chloride content of the blood may be responsible.

It is found that the excretory activities of the thyroid and adrenal glands are reduced in high temperatures and therefore the whole of the metabolism is lowered; this condition may be compensatory to the tendency to increase metabolism consequent on a hot climate.

The profuse sweating often experienced in the tropics involves a loss of chlorides—since sweat is usually hypertonic. The salty taste of this excretion is well known, and, in extreme conditions, the salt can actually be felt on the skin, when this becomes dry.

The loss of fluid from sweating causes an increased chloride concentration of the serum, and when the sensation of thirst causes the ingestion of large quantities of water, the chloride concentration becomes below normal owing to its consequent dilution. Chloride is then liberated from the body reserves, and this is again lost through sweating.

It will be seen then that continual sweating and drinking may lower the chloride concentration to a dangerously low level. This loss may be further increased if diarrhœa or vomiting is present.

The amount of chloride lost through perspiration may be very large; in profuse sweating twice as much salt may be excreted as the ordinary man consumes in all forms per day (Glover [9]). This finding emphasizes the need for the troops taking sufficient salt with their meals. They may not wish to take salt because they have previously eaten cakes to repletion, etc.

Moss [14] found that a thoroughly acclimatized miner working in an experimental hot chamber lost as much as 6½ lb. of weight in an hour when at hard work.

Research lends support to the theory that the loss of salt in the sweat of normal people is not completely balanced, in every case, by the salt ingested in the food and drink of people living an ordinary active life, and having a free choice of food.

Confirmation of this theory is given by Marsh [2] who states that it seems as though the body stocks of sodium chloride of men in the tropics are low at the end of the summer, and that there is a definite lag period before the normal sodium chloride excretion in the urine is resumed.

During the hot weather the amount excreted in the urine is below normal, and it is stated by Lee [1] that the figure should not be below 3 grammes. Marsh [2] further states that the whole blood chloride as estimated in fifty persons was:—

Actual mean..	404·12 mg./100 c.c.
Standard deviation	38·08 mg./100 c.c.

Whereas in a case of prodromal heat stroke the whole blood chloride was only 263·000 mg./100 c.c.

It is well known that the cessation of sweating and polyuria are frequent warning signs of heat stroke. The former symptom may be caused (Marsh [7]) by the sweat glands being unable to function when the blood chloride is low; it is also possible that there may be a secondary shrinkage of blood volume caused by the loss of fluid, which may also inhibit the action of the sweat glands.

As regards the polyuria: if when a man has a low blood-salt and his body reserve has been so depleted that he drinks thirstily, the tonicity of the blood and body fluids is altered and the body has to deal with the excess fluid which is excreted by the kidneys, hence the polyuria. By a quick burst of sweating more salt is lost and so a vicious circle is established which can only be broken by the ingestion of salt.

This condition of hypertonicity is termed water poisoning by Moss [14] and Haldane [11].

Lee [1] defines electrolyte imbalance on empirical grounds as a lowering of the serum chloride concentration to 100 m. equ. (mille equivalent) per litre, or 365 mg./100 c.c. or less. This should be compared with Marsh's [2] normal figures for plasma chloride, actual mean 564·08 mg./100 c.c., standard deviation 37·3 mg./100 c.c.

The connection between loss of blood chloride and the onset of muscular cramps has been well established. Cramps comparable to heat cramps are caused by cholera—here again chloride is lost. The forearm flexors and the calf muscles are the most frequently affected, and the abdominal muscles are often involved. The pain may be excruciating, as was the case in the writer's attack.

During the hot weather one frequently finds men reporting sick with vague abdominal pains. These may be very severe, and, in one case, simulated appendicitis. A diagnosis of "colic," "intestinal toxæmia," and so forth may be made, as the symptoms are so indefinite. The author's case was, in fact, diagnosed gastritis at first. These cases may well be prodromal heat stroke, and should be treated as such, as the administration of purgatives would only make matters worse.

This may be the explanation of the puzzling cases of heat stroke that occasionally arise in hospital, when the patient has been resting in bed in a comparatively cool hospital ward for several days.

Muscular cramps in heat stroke respond immediately to the injection of saline—hypertonic for choice. Lee [1] states that glucose is without effect and that sodium bicarbonate may be dangerous. On the other hand, Squadron Leader Morton [8] recommends the administration of 1 to 1½ pints of 2 per cent sodium bicarbonate in saline, and describes the relief as dramatic.

The writer has used bicarbonate and normal saline in several cases without any ill-effects.

In addition, glucose and bicarbonate as a drink are efficacious—the bicarbonate presumably being converted by gastric hydrochloric acid into chloride in the body.

Equally good results are obtained by the administration of sodium citrate or cream of tartar. The writer has used "potus imperialis" with the addition of 1 to 2 grains of sodium chloride per ounce as a palatable

and useful drink in these cases. This mixture may, in addition, be used as a prophylactic.

Another condition associated with heat stroke is a degree of circulatory insufficiency. The dilatation of the skin capillaries caused by the height of the surrounding temperature increases the capacity of the circulatory system. This can be compensated to a certain extent; but if further vaso-dilatation occurs, or the blood-volume is depleted by excessive dehydration, impairment of the circulatory system follows, with such symptoms as fainting, collapse, nausea, vomiting, respiratory disturbance, fatigue and exhaustion in severer cases.

The most frequent exciting causes of these conditions are heavy meals, injudicious use of alcohol, heavy exercise, especially under the stimulus of competition, continued standing, and emotional disturbance (Lee [1]). The milder cases can be treated by routine measures, but those more severe will require an addition to the depleted blood-volume by the injection of saline intravenously.

Marsh [2] makes some interesting speculations on a case of heat stroke associated with a glycosuria. He was of the opinion that the hypochloræmia and the reduction of blood-volume so often associated with diabetic coma were not in this case due to diabetes which existed only as a mild complication and sequela. He further remarked that in cases of experimental heat stroke in rabbits, the high blood-sugar recorded causes him to wonder whether prodromal or fully-developed heat stroke may not be a starting point, hitherto unrecognized, for diabetes.

SUPERDEHYDRATION.

Lee [1] defines this as a loss of water from the body to such an extent that continued existence is threatened should replacement not occur.

The critical level lies at about 20 to 25 per cent of the body weight. This means that if the body weight is 120 pounds this level is reached by the loss of 3 gallons of water, taking 25 per cent as the lowest survival level.

The normal water loss of a series of inmates of an Institution was investigated by Magee [3]. The average was found to be 5·07 pints in a temperate climate with no hard physical work. Lelean [15] showed that for each $7\frac{1}{2}$ miles march in a temperate climate a loss of 2 pints of water occurred. After a further $7\frac{1}{2}$ miles, with a total loss of 4 pints, slight inefficiency occurred, and after a third distance of $7\frac{1}{2}$ miles with a loss of 6 pints, marked inefficiency resulted, and after a total of 30 miles the danger level would be reached after the loss of 8 pints, if the water was not replaced.

Therefore in a 22 mile march in a temperate country, the total loss

would be 5·07 pints (Magee [3]) and 6 pints (Lelean [15]), a total of roughly 12 pints or half the loss of 25 per cent above mentioned.

These figures are, of course, only approximate; but they are of interest in showing that the water needs of troops are much larger than might be imagined, and the necessity of adequate replacement of water losses, if they are to carry out hard work without the loss of efficiency.

These requirements are of course much higher in tropical countries. Dill, Bock, Edwards and Kennedy [4] found that men working in hot mills required 5 litres (9 pints) of water in eight hours. Of this intake, only 7 per cent was excreted by the kidneys.

As eight hours is approximately the time required to march 22 miles, it will be seen that in such a march in a hot climate the water requirements would be of the nature of 9 pints as opposed to the 6 pints necessary in a temperate climate.

If we assume, for the sake of comparison, that the normal resting water loss will be 50 per cent above that requisite in a cool climate, we arrive at the figure of 18 pints required for hard work in the tropics, i.e. 75 per cent of the amount of water loss required to produce the critical level at 25 per cent total loss—the intake and excretion of water being much the same. It is admitted that this can only be a rough estimate, but it will serve as an illustration.

Dehydration, when established, is one of the contributory causes of circulatory insufficiency. As the process progresses symptoms become increasingly apparent, and, later, still more serious results will ensue. Muscular power, circulatory efficiency and alimentary functions are all primarily affected. The impairment of the circulation leads to disordered metabolism, disordered nervous function, and diminished heat loss. Disordered metabolism, in turn, leads to acidæmia, which further affects the nervous system, which again may be aggravated by the rise of temperature. The nervous disturbance becomes increasingly manifest and finally leads to coma and to death. The treatment is to restore the lost fluids by injection of saline as well as by ingestion.

Hyperpyrexia.

This condition is so well known that no detailed discussion is necessary beyond stating that it does not respond to saline administration, and is best combated by the absorption of the latent heat by evaporation of water from the skin.

Leonard Hill [16] points out that the evaporation of water at body temperature carries with it 0·59 calorie per gramme, whereas the melting of ice takes away only 0·08 calorie.

Moreover, 70 grammes of water evaporated from the skin take away as much heat as the use of 1,000 grammes of iced water as an enema.

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Moreover, 70 grammes of water evaporated from the skin take away as much heat as the use of 1,000 grammes of iced water as an enema.

The evaporation is best carried out by placing the patient on a string bed, or on a metal bed covered with permeable matting, so that moving air can have access to all parts of the body surface.

Cold water should then be sprayed on the patient and currents of air from a fan or fans should be directed on to the moistened body.

Collapse must be guarded against, and the treatment stopped when the temperature drops to 102° F.

PROPHYLAXIS.

The views as to the mechanism of heat stroke, discussed above, give us the necessary information to enable us to institute our preventive measures on scientific and practical lines.

The deleterious effects of great heat have been recognized for years in many civil occupations, such as those of stokers, blast-furnace attendants, tin-plate workers, and those in hot rolling mills and the like.

These workers have their own methods of dealing with such conditions, many of which are based, all unwittingly, on sound considerations and on the results of practical experience. Some of these methods are equally applicable to military personnel and are worthy of our consideration. For example, it has long been the custom for stokers, who may suffer from the effects of heat, particularly in the Red Sea, to take copious draughts of sea water as a remedy, and in many cases as a prophylactic, thus dealing with the loss of salt and of water at the same time. They are also hosed down with water, and stand under the stokehold ventilators to reduce their temperatures.

Dill, Bock, Edwards and Kennedy [4] report that men working in hot mills took from 0·04 per cent of salt in their drinking water in winter to 0·1 per cent in the summer and that they consumed 9 pints of this mixture in eight hours work.

The result was that all serious cases of heat exhaustion and cramp were avoided, whereas before the institution of this measure as many as twelve cases were put to bed in one day.

Miners working in deep mines where the temperature is high are also liable to suffer from the effects of heat which are known to them as "miner's cramp," "heat cramp," or "the bends." These are prevented by the drinking of salt and water as in the case of the Oogram Gold Mines mentioned previously.

McCord and Terenbaugh [10] discuss fatigue in soldiers due to chloride loss and suggest that 0·5 per cent sodium chloride in water as a drink would lessen fatigue and prevent heat exhaustion and cramps.

Starkov and Jikesh [5] recommend aerated water with the addition of 0·5 per cent salt, and Kofoed [6] also administers salt drinks.

Glover [9] finds that workers in hot industries are frequently reluctant

to drink salt water owing to the unpleasant taste. He therefore recommends the use of compressed tablets of sodium chloride, each containing 16 grains, which are obtainable from small automatic machines installed in the works.

The workmen swallow one tablet each time they take a draught of water, which may be two or three times in an hour. No ill effects were noted from this large ingestion of salt.

In a certain chemical works, known to the writer, the men add small quantities of hydrochloric acid to the water which they say makes a more palatable draught than the admixture of salt. This is not to be recommended, as the equally necessary sodium is thus omitted.

A very pleasant drink can be made by the addition of salt, either 1 to 2 grains per ounce, as may be necessary, to the ordinary potus imperialis, which can then be aerated if desired in a "sparklet" syphon. The taste of the salt is almost completely disguised, and the aerated variety can be used as a diluent for spirits.

From a practical point of view the two main desiderata for the prevention of heat stroke are an ample supply of water and a sufficient ingestion of sodium chloride. The former presents no difficulty, but, at present, no facilities exist in the Army for the administration of salt, which, in view of the high figures of saline excretion given above, is very necessary.

As a minor measure troops should have their main meal, their meat ration with its accompanying salt, in the evening, when they are most likely to eat it. The sale of tea and cakes should be prohibited for at least two hours before this meal, so that their appetite may not be already satiated by this time.

One of Glover's [9] automatic machines in each barrack room, adjacent to the drinking water supply, would seem to be the most efficient and inexpensive method of ensuring a sufficient consumption of salt.

Constipation should be avoided, but the use of strong purgatives or large doses is to be deprecated owing to the further depletion of salt during purgation. For this reason the treatment of dysentery with magnesium and sodium sulphates should be watched in very hot weather.

If, however, it is found that large numbers of men are constipated, a useful measure is to administer a small dose of magnesium sulphate under regimental arrangements in the troops' own lines each Sunday morning after Church Parade. This is usually a popular measure as it saves a walk to the hospital.

We now come to a very vexed question, that of exercise, which, in the right time and of the right sort, is essential to preserve bodily fitness. The beneficial effects of sanely-regulated exercise are so obvious that the unthinking are led to regard it as a panacea for all things at all times.

Any white man in the tropics has only a certain amount of energy at his disposal. If he dissipates all of this in too strenuous exercise he will have nothing left with which to fight the results of the unfavourable climate in which he is situated.

The most incredibly foolish exhibitions of the exercise complex are frequently to be seen. One soldier, a boxer wishing to reduce his weight, was seen running for five miles clad in a singlet, two woollen cardigans and no head covering at 3 o'clock in the afternoon when the shade temperature was 118° F. He was quite unable to understand why he was peremptorily ordered back to his room, or why he was punished next day.

Two young officers complained of feeling faint after playing squash in an uncovered court, the temperature in which was found to be 125° F. owing to radiation from walls exposed all day to the sun.

Again, one sees four elderly men playing four or five sets of hard tennis in the height of the hot weather. The incipient cyanosis of their lips betrays the strain which their circulation has, with difficulty, dealt. Only the administration of what the old-fashioned doctor would call "diffusible stimulant" will restore their colour to normal again.

The men as a whole are frequently exercised far too strenuously in the hot weather, partly as a relief from their day-long incarceration in their barrack rooms, and partly in the hope that it will render them fitter and enable them to resist more effectively the effects of the climate. The fact is, however, that the profuse sweating after strenuous exercise following upon the sweating of a whole day is but paving the way to collapse when the temperature is high.

The native inhabitant of a hot country, after centuries of experience, retires to his house during the heat of the day, and avoids exertion as much as possible. The zemindar and the coolie alike do no work at this time, and only "mad dogs and Englishmen go out in the midday sun."

A frequent cause of collapse is standing for long periods (Lee [1]). It is well known that any lengthy ceremonial parade in the hot weather will always provide the odd case of heat stroke.

A dramatic instance was the collapse of three men on the railway platform at Jhansi at midnight. The temperature and moisture were high —the men had been standing about for several hours and were rather excited at the prospect of leaving a hot and dusty station for the green and cool of the hills.

While an alcoholic person is notoriously predisposed to heat stroke, a strictly moderate use of alcohol would appear to be almost a necessity for the white man in the tropics, if only to give him an appetite, often otherwise lacking, for his evening meal, also to mitigate to some extent the boredom of the long hot day, to assist him to ingest sufficient fluid to replace that lost during the heat of the day, and finally to help him to sleep under what may be very trying conditions.

Sleep is a most important factor in the avoidance of heat stroke. When the temperature is high at night—in some cases it does not drop below 105° F.—sleep is difficult, and it is only in the early hours of the morning that restful slumber can be obtained. This is shattered by a too early réveillé, and the men are deprived of the better part of an hour's comfortable sleep in the comparative cool of the dawn.

By early réveillé and early return to barracks it is hoped that all outdoor work will be completed before 10 a.m. The wisdom of this is open to question. The practice of keeping men confined in darkened barrack rooms for long hours appears to be unnecessary if the precautions outlined above are taken.

If workmen can toil for long hours near blast furnaces in tin-plate works, in hot mills, or deep underground, performing the most strenuous work with no serious casualties, it would seem that soldiers, who ought to be in better physical condition, should be able to withstand the not very different temperatures of the tropics.

If, in an emergency, they have to be called out in the hot weather, they are less able to withstand the heat, not having been exposed to the sun. The mental effect of such a day-long confinement cannot be good for anyone, and mental depression may explain the occasional "running amok" of the men.

There is little for the men to do in their rooms but sleep. Hours of lying in bed certainly do not conduce either to physical fitness or to mental alertness.

It is to be noted that, on most days, officers in India have to remain in their offices until the period of maximum heat, and appear to suffer no inconvenience by returning home to tiffin, not infrequently on a bicycle. Medical officers in particular are often called out in the afternoon, the hottest time of the day, to attend emergencies, from which duties no one seems to have suffered any ill-effects.

Many of us, too, can remember with pleasure long hours of tramping in the jungle on "shikar." No one was any the worse for this.

It may be thought that these last paragraphs are contradictory to the previous remarks on exercise. Gentle and reasonable exercise can do no damage, but when it is pursued to the point of excessive perspiration and of strain to the circulatory system then a caveat should be entered.

To sum up. Nothing very original is claimed for this contribution, but as the literature on this interesting and not always fully understood subject is not readily available, particularly to those serving abroad, it is hoped that this account may assist those stationed in the tropics to realize that the last word has not been said, and that there is much scope for original research to extend the boundaries of our knowledge.

With this end in view, the papers in the bibliography have been quoted

Any white man in the tropics has only a certain amount of energy at his disposal. If he dissipates all of this in too strenuous exercise he will have nothing left with which to fight the results of the unfavourable climate in which he is situated.

The most incredibly foolish exhibitions of the exercise complex are frequently to be seen. One soldier, a boxer wishing to reduce his weight, was seen running for five miles clad in a singlet, two woollen cardigans and no head covering at 3 o'clock in the afternoon when the shade temperature was 118° F. He was quite unable to understand why he was peremptorily ordered back to his room, or why he was punished next day.

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fairly freely. The writer, therefore, desires to express his acknowledgment to those from whom he has obtained much of his information.

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THE ANTIGENIC STRUCTURE OF THE MANNITOL-FERMENTING GROUP OF DYSENTERY BACILLI.[1]

By Major[2] J. S. K. Boyd,
Royal Army Medical Corps.

In the years 1929-31 a study was made of the mannitol-fermenting dysentery bacilli isolated from cases in the military hospitals of India (Boyd, 1931, 1932). Several new members of this group, previously classified as "inagglutinable", were identified by serological methods, and subsequently a scheme of identification based on these findings was applied throughout the military laboratories of India. Some of the results of this investigation have already been published (Boyd, 1936).

As it will be necessary to refer to these new types in this paper, an analysis of 4,856 strains isolated in the years 1932-5 is given in Table I. This table does not include late fermenters of lactose and sucrose, but, apart from these, embraces all the various types of mannitol-fermenting dysentery bacilli. It includes as far as possible every strain having these characters which was isolated in this period, and therefore offers a reasonably accurate index of the frequency with which these types occur in India. As a temporary measure, pending the acceptance of a more accurate classification, the new types are named by the index number of the type strain.

Table I.—Analysis of all Mannitol-fermenting Dysentery Bacilli (except Late Fermenters of Lactose and Sucrose) Isolated in Military Laboratories in India in the Years 1932-35.

Type of organism	Number	Percentage
Andrewes' V-Z series	3686	75·9
Type 103	199	4·1
P 119	131	2·7
88	371	7·6
170	190	3·9
P 288	64	1·3
P 274	75	1·5
D 1	67	1·4
D 19	8	0·2
P 143	16	0·4
Type unknown	49	1·0
Total	4856*	

* Excludes 95 strains discarded before typing had been carried out.

In all cases identification was effected by biochemical and serological tests. The V-Z series includes all those which agglutinated with anti-

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[1] Reprinted from the *Journal of Hygiene*, Vol. 38, No. 4, by permission of the Editor.

[2] Now Lieutenant-Colonel.

serums prepared from V, W, X, Y and Z races as defined by Andrewes and Inman: the others were identified by means of serums prepared from the type strains.

In the course of this work a hitherto undescribed form of variation was observed to occur in certain strains. A superficial investigation of this phenomenon showed that it threw considerable light on the antigenic structure of the group as a whole, and probably gave a clue to the vexed question of classification. It was, therefore, decided to study the matter more closely.

Materials and Methods Employed.

Organisms.

(*Note.*—For brevity, the familiar symbols of the Flexner group are freely used—e.g. V for *B. dysenteriæ* Flexner V, etc. The National Collection of Type Cultures, Lister Institute, is referred to as "N.C.T.C.")

V: V Oxford (N.C.T.C.); V Lentz (Dr. Scott).

VZ: VZ Massom, VZ Stansfield (both N.C.T.C.); VZ/D 427 (Major Bensted).

W: W Cable (N.C.T.C.).

X: X Hughes (N.C.T.C.); X Kelly (Dr. Scott).

Z: Whittington (N.C.T.C.).

Y: Y Hiss Russell (N.C.T.C.); Y Lentz (Dr. Scott).

103: type strain: 103/P 166; 103/Mohd. Zaman; and others; all isolated in India.

P 119: type strain; P 119/493 (India).

88: type strain; 88/Q 6 (India).

Newcastle: Newcastle/Aberdeen (Dr. Scott).

170, P 288, P 274, D 1, D 19, P 143: type strains.

In addition, a large number of strains isolated by the writer, or received from colleagues in India and Egypt, and from Dr. W. M. Scott, Ministry of Health, have been used for confirmatory tests.

Antiserums.

Antiserums were prepared by inoculating rabbits intravenously with graded doses of organisms either as broth cultures, or in the later stage of immunization as saline suspensions. In both cases the organisms were killed either by chloroform or by formalin. Owing to the variable agglutinin response of the rabbits, no standard course was followed. Injections were continued until a serum of suitably high titre was produced.

Suspensions for Agglutination.

Agglutinable suspensions were prepared by growing the organism in broth for twenty-four hours. Thereafter 0·2 per cent formalin was added to kill the organisms and to act as a preservative, and the suspensions were standardized to a constant opacity.

Suspensions for Absorption.

Suspensions for absorbing purposes were prepared by growing the organisms on Gordon's peaflour tryp-agar in Roux bottles, washing off with saline, killing and preserving with chloroform, and standardizing, after concentrating by spinning, to contain 100,000 million organisms per millilitre. Absorbing suspensions were prepared in bulk from 103 B, Y Hiss Russell, P 119 B, V Oxford, W Cable, X Hughes and Z Whittington.

Absorption Tests.

1 millilitre of serum was absorbed with quantities of organisms varying from 50,000 millions to 500,000 millions (i.e. 0·5-5 millilitres of absorbing suspension), the whole being made up to a volume of 10 millilitres with normal saline. The mixture was kept in the water-bath at 50° C. for four hours, then placed in the incubator overnight, and if necessary, centrifuged next morning. Controls containing no suspension were placed in the water-bath and incubator for the same time as the actual tests; these are the controls shown in the tables.

Agglutination Tests.

Agglutination tests were performed by Dreyer's technique. The tubes were incubated at 50° C. for four hours, and the results were at once read against a special dark background, using a hand lens to determine the finer degrees of agglutination. Intermediate results were calculated by means of Dreyer's interpolation table, slightly modified. Nil results indicate a titre of less than 1 in 10.

I.—Antigenic Variation in the Mannitol-fermenting Dysentery Bacilli.

Type 103.

Variation was first observed, and has been studied in most detail, in type 103. This is believed to be one of the original Y strains, probably Y Lentz, of which only group variants now exist.

When newly isolated, 103 did not agglutinate with antiserums prepared from the V, W, Z and Y races, and agglutinated very feebly with X antiserum. After some time in artificial culture, however, it was observed to produce two types of colony. One of these which may be called 103 A, was in all outward respects identical with the colonies of the freshly isolated strain, being smooth in character, and virtually inagglutinable with antiserums of the V-Z series. It differed only in having acquired the power to reproduce both daughter colonies having its own characters, and variants of the kind about to be described. The second type of colony, which may be called 103 B, could be distinguished by its naked eye appearances, being larger than normal and somewhat rough in outline.

These appearances were not, however, accompanied by the characters of roughness defined by Arkwright (1921): cultures from 103 B colonies grew with uniform turbidity in broth, while agar cultures could be evenly suspended in normal saline. Suspension of 103 B proved to be readily agglutinated by the V-Z antiserums. 103 B further differed from 103 A in that it bred true, producing only colonies of its own type; with one unexplained and doubtful exception, this has proved to be a permanent character.

In unselected subcultures from the original strain the variant colonies were at first scarce. In time their numbers increased, and ultimately they dominated the picture to the exclusion of the others. The process was, therefore, a steady progression from a pure 103 A culture to a pure 103 B culture.

Variation of this kind has occurred in the majority of the 103 strains which have been examined. In some cases the variant appeared in a few

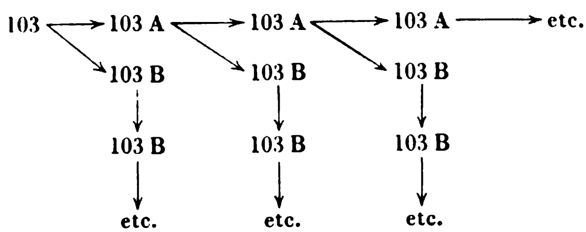

Fig. 1.

days or weeks after the strain was isolated: in others it did not appear for some months; and in certain strains, now several years old, it has not yet been found. In a few strains the variants could not be distinguished by the appearance of the colonies, all of which were smooth and regular; they were to be found only by testing the agglutination reaction of a number of colonies.

The variation is illustrated diagrammatically in fig. 1.

Cross-agglutination tests with 103 A, 103 B and the V, W, X, Y, Z strains, and also certain absorption tests, are shown in Table II.

Table II.—Certain Agglutination and Absorption Tests with 103 A and 103 B.

	103 A	103 B	V	W	X	YHR	Z
103 B suspension agglutinated by antiserum	400	100·0	60	100	100	100	80
103 A ,, ,, ,, ,,	100	1·5	—	—	5	—	—
103 A antiserum against suspension	100	400·0	25	15	40	40	8
103 A antiserum absorbed 103 A	—	4·0	—	—	—	—	—
103 A antiserum absorbed 103 B	100	5·0	—	—	—	—	—
103 A antiserum absorbed YHR	100	5·0	—	—	—	—	—

Note.—The figures in this table are percentages of the titre of the serum in question for its homologous organism.

The high titre to which 103 B is agglutinated by the antiserums of the Flexner organisms is a striking feature, and indicates that it shares a common antigen with these strains. As far as 103 A is concerned, there is little evidence from the way in which it is agglutinated by these antiserums to suggest that it contains any of this shared antigen: on the other hand, its homologous antiserum has a well-marked action on the allied organisms, a result which indicates that it does in fact possess this antigen.

103 A antiserum, when absorbed by its homologous organism, loses all agglutinins except a trace of group agglutinin. (It may be remarked that the removal of the last traces of group agglutinin from high titre antiserums has always presented considerable difficulties in certain cases. This is probably due to some inherent property of rabbits' serum.) When absorbed by 103 B, 103 A antiserum loses all group agglutinin (except these same traces), but retains its power to agglutinate the homologous organism.

From these results it may be concluded that 103 A contains two antigens: one, a specific or type antigen which is peculiar to itself; the other, a group antigen which it shares with the V-Z series. 103 B, on the other hand, contains only group antigen; it is devoid of any power to absorb type agglutinin from 103 A antiserum, but readily removes the group agglutinin.

The somewhat conflicting observations that 103 A, while almost inagglutinable with group antiserum, is nevertheless capable of producing group agglutinins, may be explained in several ways.

(i) The supposedly pure 103 A suspension used for immunizing the rabbit may have contained a few 103 B organisms. Results similar to those in Table II have, however, been given by a 103 A strain of undoubted purity, which has now been under observation for six years without showing any variant colonies. This explanation, therefore, seems unlikely.

(ii) 103 A bacilli may contain in an accessible position a mixture of large quantities of type antigen and minute quantities of group antigen, the latter insufficient to be clumped by group agglutinin, but sufficient to give rise to agglutinins in the rabbit.

(iii) The type antigen in 103 A may be situated in a superficial or dominating position, while the group antigen may be more deeply seated and in some way protected or inactivated by the type antigen. Under these circumstances, when the organisms are brought in contact with type agglutinin clumping occurs in the usual way, but when they are exposed to the action of group agglutinin, there is no reaction, as the agglutinin cannot obtain access to its antigen. On the other hand, when the organisms are inoculated into a rabbit, disintegration of the bacterial

bodies occurs, accompanied by freeing of the antigens, each of which proceeds to give rise to its appropriate agglutinin.

There are points both for and against the last two hypotheses. The proportion of group agglutinin is so high in 103 A antiserum that it is difficult to understand how it can be produced by quantities of antigen so minute as to be insensitive to agglutination. Conversely, a suspension of 103 A is capable of absorbing practically all group agglutinin from its own antiserum; this is difficult to reconcile with the conception of a concealed group antigen inaccessible to the action of its antibody.

Another observation which has an important bearing on this question is that 103 B has more powerful agglutinogenic properties than 103 A, producing an antiserum with a much higher group titre. While this might be explained by the fact that in 103 B the group antigen is completely freed from type antigen and is thus of enhanced quality, the simpler explanation that 103 B contains an increased quantity of group antigen seems more probable.

As the two hypotheses are not antagonistic, it is probable that both play a part in the phenomenon.

These questions are of importance in reaching an understanding of the nature of the variation in 103. This is clearly a retrogressive process in which there is loss of type antigen, and coincident exaltation of group antigen. It is a general rule that in any process of degeneration the more highly specialized structures are the first to be lost, and it may be concluded that the type antigen, which is a distinctive character of the organism, falls into this category. In contrast with the loss of type antigen, the group antigen obtains prominence in the degraded variant, partly no doubt because of the removal of the protective or inhibitory influence of the type antigen, but also because there is an increase in the quantity of group antigen which may be in the nature of a replacement proliferation. This would suggest that group antigen is of a more primitive nature than type antigen.

This variation of 103 differs radically from the diphasic variation which occurs in the flagellar antigen of the Salmonella group. In the latter the process is not accompanied by permanent loss of antigen. Reversion from one phase to another may occur at any time, and bacterial cells of both types, each capable of producing its own antigen, are present in all colonies although, according to the phase, one type or the other predominates.

A form of variation which occurs in certain strains of streptococci, notably types 3, 13, and 19, has been described in detail by Griffith (1935). This bears a close resemblance to the variation which occurs in 103. When *Streptococcus* type 3 was plated on an agar medium in which was incorporated about 2 per cent of homologous agglutinating serum, three types of colony could be recognized, one opaque, another translucent, and

a third showing both opaque and translucent sectors. Serological investigation showed that the opaque colonies had type-specific characters, and that the translucent colonies had group characters, while the mixed colonies had both. In a plate made from an actively growing unselected subculture type-specific colonies were rare, group colonies rather more common, and mixed colonies in a majority. When a type-specific (i.e. opaque) colony was subcultured and replated, a more or less similar crop of colonies to that just described was produced. When a group (i.e. translucent) colony was similarly plated, it reproduced mainly translucent colonies, but a few mixed colonies showing both clear and opaque areas appeared on the plate. Even after oft-repeated subculture from selected translucent colonies this mixed character remained, and from the tiniest opaque focus it was possible to produce on transference to a fresh plate opaque colonies which could be shown to be type-specific. The general tendency, however, was for type-specific cultures to assume group characters in artificial culture. Griffith notes the similarity of this variation to that observed in certain Flexner types (notably W and Y) by Dr. W. M. Scott. It also closely resembles the variation in 103. There is, however, one important difference. In the streptococci, as Griffith observes, there is the same fluctuation of phases which has been observed in the flagellar antigen of the Salmonella group; type specific colonies can be recovered from cultures of the group phase, and vice versa. In 103 the change is permanent; type-specific colonies cannot be recovered from the group phase.

There are also many points of similarity between the 103 variation and that which occurs in the *melitensis-abortus* group (Pandit and Wilson, 1932). Here a similar permanent loss of specific antigen occurs. Unlike "*para-melitensis*" and "*para-abortus*," the 103 variants, and other Flexner variants which will be described later, give negative results with the thermo-agglutination test, and with Millon's reagent.

It is worthy of mention that in the course of this investigation true "rough" variants of the kind described by Arkwright (1921) have occasionally been encountered in cultures of the Flexner races. These had the accepted characters of roughness, and seemed to be almost completely devoid of any antigen capable either of being agglutinated or of producing agglutinin when inoculated into a rabbit. In other words, the degeneration had proceeded a stage further, and both type and group antigen had been lost.

Y Hiss and Russell (YHR) and W.

In carrying out various investigations in connexion with 103, it was observed that the Hiss and Russell Y strain had absorptive properties almost identical with 103 B. This can be seen in Table II. At first the two were believed to be identical, but more recent work has shown that

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a third showing both opaque and translucent sectors. Serological investigation showed that the opaque colonies had type-specific characters, and that the translucent colonies had group characters, while the mixed colonies had both. In a plate made from an actively growing unselected subculture type-specific colonies were rare, group colonies rather more common, and mixed colonies in a majority. When a type-specific (i.e. opaque) colony was subcultured and replated, a more or less similar crop of colonies to that just described was produced. When a group (i.e. translucent) colony was similarly plated, it reproduced mainly translucent colonies, but a few mixed colonies showing both clear and opaque areas appeared on the plate. Even after oft-repeated subculture from selected translucent colonies this mixed character remained, and from the tiniest opaque focus it was possible to produce on transference to a fresh plate opaque colonies which could be shown to be type-specific. The general tendency, however, was for type-specific cultures to assume group characters in artificial culture. Griffith notes the similarity of this variation to that observed in certain Flexner types (notably W and Y) by Dr. W. M. Scott. It also closely resembles the variation in 103. There is, however, one important difference. In the streptococci, as Griffith observes, there is the same fluctuation of phases which has been observed in the flagellar antigen of the Salmonella group; type specific colonies can be recovered from cultures of the group phase, and vice versa. In 103 the change is permanent; type-specific colonies cannot be recovered from the group phase.

There are also many points of similarity between the 103 variation and that which occurs in the *melitensis-abortus* group (Pandit and Wilson, 1932). Here a similar permanent loss of specific antigen occurs. Unlike "*para-melitensis*" and "*para-abortus*," the 103 variants, and other Flexner variants which will be described later, give negative results with the thermo-agglutination test, and with Millon's reagent.

It is worthy of mention that in the course of this investigation true "rough" variants of the kind described by Arkwright (1921) have occasionally been encountered in cultures of the Flexner races. These had the accepted characters of roughness, and seemed to be almost completely devoid of any antigen capable either of being agglutinated or of producing agglutinin when inoculated into a rabbit. In other words, the degeneration had proceeded a stage further, and both type and group antigen had been lost.

Y Hiss and Russell (YHR) and W.

In carrying out various investigations in connexion with 103, it was observed that the Hiss and Russell Y strain had absorptive properties almost identical with 103 B. This can be seen in Table II. At first the two were believed to be identical, but more recent work has shown that

this is not so, and that, as Dr. W. M. Scott has suggested (personal communication), YHR is probably derived from a W strain, and embodies the group antigen of that organism.

Cross absorption tests with 103B and YHR show that neither completely exhausts the agglutinin in the antiserum of the other.

On the other hand, absorption of W antiserum with YHR almost completely removes the group agglutinin which it contains (*see* Table III). Similar complete absorption is not effected by 103 B, nor by P 119 B, another group variant which will be described shortly.

In the process of absorbing W antiserum with YHR, there is a considerable reduction in the titre of the antiserum for its homologous organism W, suggesting that YHR contains some specific W antigen. This fall in specific agglutinin, however, reaches a point beyond which massive increases in the absorbing dose of organisms produce no further loss. It seems probable, therefore, that the fall in titre for W merely represents the elimination of group agglutinin which reacted to higher titre than did the specific agglutinin.

Absorption of the antiserums of the other members of the Flexner

TABLE III.—ABSORPTION OF W ANTISERUM.

	Suspensions						
Antiserum	V	W	X	Z	103 B	YHR	P 119 B
W, control	350	6000	1000	250	1250	10000	500
W, absorbed YHR (1×10^{11})* ..	250	2500	500	—	30	125	50
W, absorbed YHR (2×10^{11}) ..	50	1000	50	—	—	50	—
W, absorbed YHR (3×10^{11}) ..	30	1000	50	—	—	10	—
W, absorbed YHR (5×10^{11}) ..	30	1000	—	—	—	—	—
W, absorbed 103 B (5×10^{11}) ..	300	2500	500	—	10	3000	—
W, absorbed P 119 B (5×10^{11})..	250	5000	750	—	250	3000	—

* *Note.*—In this and in subsequent tables, these figures denote the number of organisms with which 1 ml. of the serum has been absorbed.

group with YHR gives results resembling those obtained with 103 B, and confirms that YHR is devoid of type antigen.

As far as the writer's experience goes, organisms having the characters of YHR have never been isolated direct from the stools of dysentery cases, and the resemblance which the colonies of this strain bear to those of 103 B suggests that, like the latter, it is a variant. Up to date, no colonies exactly similar to YHR have been recovered from known W strains, but investigations on this point are incomplete. Colonies which show a marked increase in group antigen and a less obvious decrease in specific antigen can be recovered from certain strains of W, but no colonies completely devoid of specific antigen have so far been found.

There is, therefore, no conclusive proof that YHR is derived from a W strain, but there is strong presumptive evidence that this is so.

Type P 119.

A similar form of variation was observed in type P 119 after this strain had been kept in artificial culture for approximately five years. When first observed this variation was diphasic, i.e. A and B colonies each produced A and B daughter colonies. The degradation progressed rapidly, and in less than a year no true A colonies could be recovered from any cultures of this organism.

The "rough" characters of the variant P119B are more marked than those of 103B. In broth it grows with a well-marked deposit, but this when shaken up remains in suspension, so that no difficulty is experienced in carrying out agglutination tests. Cultures on agar form an even suspension when washed off with isotonic saline.

In the only other old strain of this type which is available there is no evidence of variation.

The results of absorption tests with P119 antiserum and the three group strains are shown in Table IV.

P119B almost completely exhausts the group agglutinin in the serum without appreciably affecting the type agglutinin. 103B and YHR have a similar action, but fail to remove agglutinin for either P119A or P119B.

TABLE IV.—ABSORPTION OF P 119 ANTISERUM.

Antiserum P 119	Suspensions							
	P 119 A	P 119 B	V	W	X	Z	103 B	YHR
Control	5000	1500	30	50	175	350	600	1000
Absorbed P 119 B (2×10^{11})..	5000	15	—	—	—	—	25	35
Absorbed 103 B (2×10^{11})..	5000	1000	—	—	10	—	—	25
Absorbed YHR (2×10^{11})..	5000	1500	—	—	—	—	—	—

It may, therefore, be concluded that P 119 B has lost the type antigen, but retains the group antigen of the parent organism. This group antigen has much in common with the group antigen of 103 B and YHR, but has in addition an element peculiar to itself.

V, X and Z.

Variants devoid of specific antigen have not yet been isolated from V, X and Z, but colonies with decreased specific antigen and an apparent increase in group antigen are to be found in certain strains of V and Z. It is not at present possible to make a definite statement regarding X.

Takita (1937) has made some interesting observations regarding variation in these types. On examining certain old strains of V, W and Z, he found that two varieties of colony were present in plates made from these organisms. These colonies could be differentiated by agglutination with the antiserums of the group. One of the colonies, which Takita designated *a*, was agglutinated to high titre both by the antiserum of its

own type, and by the group antiserums. The other colony, called *b*, gave a lower titre than *a* with the homologous antiserum, and was only feebly agglutinated by the group antiserums. On sub-culture, *a* colonies reproduced only *a* colonies, whereas *b* colonies, produced both *a* and *b* varieties.

This variation, described in detail in the case of the strain V Lentz, can be shown diagrammatically (fig. 2).

Further experiments were carried out with antiserums prepared from V *a*, and V *b* substrains. It was found that the results were not easy to interpret, and were in no sense decisive, but it was concluded that the V *a* substrain contained both specific and group antigen, whereas the V *b* substrain had lost all or most of the group antigen.

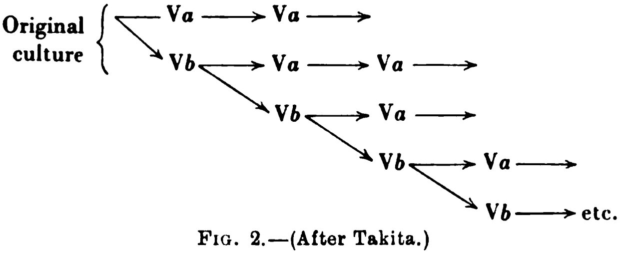

Fig. 2.—(After Takita.)

From these findings Takita suggests that the main difference between the parent V strain and the V *a* substrain lies in the antigenic instability of the former (which produced both V *a* and V *b* forms) and the stability of the latter (which produced only V *a* forms); while the V *b* variant has lost, completely or almost completely, the group antigen, but shows a constant tendency to revert to the form in which group antigens are present. He regards this variation of the V *b* form as a phasic variation of an O antigen of the same type as that described by Andrewes as occurring in the flagellar antigens of the typhoid-paratyphoid group.

In qualification of his conclusions regarding the V *a* substrain, Takita remarks that the possibility of the original culture containing both *a* and *b* forms cannot be excluded. This is, however, much more than a mere possibility. This variation in V Lentz is of long standing, and while from the beginning of his investigation Takita had no difficulty in isolating *a* and *b* forms from plates made from his original culture, he produces no evidence of the presence of a third type of colony—the parent colony producing both *a* and *b* substrains. Nor, as *b* forms are constantly producing both *a* and *b* forms, does there seem any necessity to postulate the existence of a parent type of colony at this stage in the life of the culture.

While this does not alter the ultimate conclusions reached by Takita regarding the antigenic content of the substrains, it simplifies the interpretation of many of his results, and points to a more probable explanation

of the variation he has observed. There can be little doubt that the *b* forms are the existing representatives of the parent strain, and that they have acquired in artificial culture the property of splitting off degraded variants, the *a* forms. It is of course possible, but unlikely, that this property of splitting off variants was a primary character of the strain.

Interpreted in this way the variation in V is closely comparable to that occurring in 103. The V *b* forms correspond to 103 A in that they contain type antigen and, possibly, concealed group antigen, and in that they give rise to similar daughter colonies and to variants. The V *a* forms correspond to 103 B in that they are rich in group antigen and reproduce only daughter colonies similar to themselves; they differ in that they retain a portion of type antigen.

This explanation of Takita's findings is incompatible with the idea that the variation he has observed is of the nature of a phasic variation of O antigen. On the other hand, if it is correct it confirms and extends the observations already made in respect of 103 by demonstrating an analogous variation in other members of the group.

One further point is worthy of notice. The variants which appear in cultures of V and Z do not overgrow the parent type of colony in the same way as do the variants of 103 and P 119. Both types of colony have been found in certain strains over a period of years. This appears to be characteristic of strains in which the variant retains some of the type antigen, as opposed to those in which type antigen is completely lost.

Type 88.

So far no antigenic variation has been observed in 88, a type which is of great interest because its antigen is identical with that of the Newcastle bacillus. There is, however, considerable evidence to suggest that the type K described by Sartorius and Reploh (1932) is derived from 88. On grounds of analogy it is to be anticipated that variants would be formed by type 88.

Other Types.

No variants have been found in cultures of 170 or of any of the other less common types.

Summary and Conclusions.

Variation is of common occurrence in strains of mannitol-fermenting dysentery bacilli when they have been maintained in artificial culture for some time.

The essential features of this variation are a loss, partial or complete, of type antigen, and an increase, apparent or real, of group antigen. The distinctive characters of the organism disappear and retrogression towards a type common to all races occurs.

The process of variation is of a similar nature in all races. Variants,

whose characters are permanent, are split off from the parent strain, and are generally, although not always, to be recognized by their altered colony characters as well as by their altered antigenic content. The production of variants is scanty at first. In certain races which produce a variant devoid of type antigen, the process is rapidly progressive, and in time colonies of the parent type completely disappear. In others, where the loss of type antigen is incomplete, a state of balance seems to be reached, and in unselected subcultures both forms of colony occur over long periods of years.

Three strains which possess only group antigen, and are devoid of type antigen, have been examined. Two of these are of known parentage, having taken origin from types 103 and P119 respectively. The third is the current edition of the historical strain Hiss and Russell Y, which is believed to be a variant of Andrewes and Inman's W. These three strains are very closely related to one another, but display minor differences in their antigenic pattern.

Considered as a whole, the changes which occur in the process of variation favour the hypothesis that type antigen is a recent and specialized individual character which occupies a superficial position or is relatively loosely associated with the bacterial body, while the group antigen is a more primitive and permanent character, more deeply seated in or more intimately blended with the body of the bacillus. Further, it seems reasonable to conclude that organisms which possess this group antigen are closely related to each other. This has, therefore, a very important bearing on questions of classification.

II.—Analysis of the Antigens in the Mannitol-fermenting Group of Dysentery Bacilli, and its Bearing on their Classification.

Since the discovery of mannitol-fermenting dysentery bacilli at the beginning of the present century, repeated efforts have been made to classify these organisms and to define their relationship to one another. The most complete survey of the subject is that made by Andrewes and Inman (1919), whose classification of the group into the races V, W, X, Y, and Z has undergone little modification, and is still generally accepted as the basis of our knowledge on the subject.

Andrewes and Inman's conclusions may be summarized very briefly as follows: They consider that in these organisms there are present at least four distinct antigenic components, all of which are represented in any given strain, but to a very different degree. In the races V, W, and Z there is a great preponderance of a single antigenic component, different in each case, together with a minor proportion of the components of the associated types. The race X refuses to agglutinate with any but sera of its own race, save to a trivial degree, but is able to give rise to a serum

which will agglutinate X, Z, and V races. The true Y race is believed to be of more primitive antigenic structure than the others, and to present a mixture of V, W, and Z, and to a lesser extent X components: there is no evidence of a fifth, or Y, component. Subraces termed VZ and WX are also recognized.

Andrewes and Inman realized that the number of strains at their disposal was limited, and that in a more extensive collection further types would probably come to light. This has proved to be correct, and these strains, frequently referred to as "inagglutinable Flexner bacilli," have provided a recurring stimulus to the further investigation of this subject. Mention may be made of the work of Aoki (1921, 1923), who described twelve types of dysentery bacilli (including Shiga's bacillus): of Clayton and Warren (1929*a*, *b*) and Downie *et al.* (1933) who described the Newcastle-Manchester bacillus: of Sartorius and Reploh (1932), who implemented the usual methods of study by investigating reaction to bacteriophage and described certain additional types: and of Waaler (1935), who studied "bacterial dissociation" in the group. These are but a few of the many approaches which have been made to the subject. In none of them is there any important departure from the general ideas enunciated by Andrewes and Inman, and the only new type described which has found general acceptance is the Newcastle-Manchester bacillus.

The recognition of type and group antigen in these organisms, brought to light by the experiments made with the variants of 103, suggested a different conception of the antigenic structure of the various members of the group. It seemed possible that, as suggested by Andrewes and Inman, each race possessed a distinctive type or specific antigen, but that co-agglutination resulted, not because of the presence in each of a minor proportion of the type antigen of the other races, but because each possessed, in addition to its own type antigen, a varying proportion of a common group antigen.

An early series of experiments was carried out by absorbing antiserums of V, W, X and Z, of relatively low titre, with 103 B. The results substantiated this hypothesis, and seemed to show that the common group antigen was present—in its entirety—in 103 B. Subsequent experiments with high-titre antiserums, however, showed that in certain antiserums the group agglutinin is not completely exhausted by 103 B.

Cross absorption tests were then carried out with the three strains believed to be pure group strains, namely 103 B, YHR, and P119 B. The results are shown in Table V.

None of these antiserums is completely absorbed except by its homologous organism, and even then traces of agglutinin remain, notably in Y. But whereas YHR almost completely exhausts the group agglutinin in 103 B antiserum and vice versa, P119 B is less effective in absorbing 103 B and YHR antiserums.

TABLE V.—CROSS-ABSORPTION OF 103 B, YHR, AND P 119 B.

Serum	Suspension						
	V	W	X	Z	103 B	YHR	P 112 B
103 B, control	75	50	125	2500	5000	5000	1000
103 B, absorbed 103 B ..	—	—	—	—	—	—	—
103 B, absorbed YHR ..	—	—	—	20	150	125	—
103 B, absorbed P 119 B ..	—	—	—	125	250	>250	—
YHR, control	25	50	75	500	1000	2500	600
YHR, absorbed 103 B ..	—	—	—	50	30	500	50
YHR, absorbed YHR ..	—	—	—	—	—	250	—
YHR, absorbed P 119 B ..	—	25	—	150	>250	1250	—
P 119 B, control	125	50	250	2500	2500	2500	5000
P 119 B, absorbed 103 B ..	—	—	—	—	—	—	1750
P 119 B, absorbed YHR ..	—	—	—	15	30	—	2500
P 119 B, absorbed P 119 B ..	—	—	—	—	—	—	—

It is therefore possible that 103 B and YHR share an antigen containing two components, which may be designated 1 and 2, of which P 119 B possesses only component 1. Each of the three has a residual component peculiar to itself, so that the content of each may be designated as follows:—

103 B : components 1, 2, 3.
YHR : components 1, 2, 4.
P 119 B : components 1, 5.

Of these components, 1 strongly predominates, and 2, 3, 4 and 5 occur usually in smaller quantities.

As will be seen later, absorption of V, W, X and Z antiserums confirms these findings, but reveals the presence of yet another group component not found in any of these three group strains. This is present in V, X and Z, and may be called component 6.

Using the three group strains as absorbing agents for components 1, 2, 3, 4 and 5, and either X or Z for component 6, an analysis has been made of the group antigen present in the different races.

B. dysenteriæ *Flexner V* (*Oxford*).

The analysis of this strain will be given in some detail, to make clear the methods adopted.

The antiserum used in these tests agglutinated its homologous organism in a dilution of 1 in 20,000. Preliminary absorption tests were carried out with this serum diluted 1 in 10, and the results are shown in Table VI.

It will be seen that the maximum absorbing effect is usually produced by a dose of 100,000 million organisms. The titre for the homologous organism is reduced by about 50 per cent. The greater portion of the heterologous agglutinin is removed by 103 B and YHR, and to a lesser extent by P 119 B. Each removes the agglutinin acting on itself, the last traces of YHR going with reluctance. YHR and P 119 B exhaust the group agglutinin for W more effectively than does 103 B. This is to be

TABLE VI.—ABSORPTION OF V ANTISERUM WITH 103 B, YHR, AND P 119 B.

Serum V diluted 1 in 10		Suspensions V	W	X	Z	103 B	YHR	P 119 B
Control ..	.. ..	2000	75	275	600	1000	2000	125
Absorbed 103 B	($0\cdot5 \times 10^{11}$)	1500	50	100	125	—	35	10
	($1\cdot0 \times 10^{11}$)	1125	35	85	85	—	35	35
	($1\cdot5 \times 10^{11}$)	1125	30	75	85	—	35	30
	($2\cdot0 \times 10^{11}$)	1125	25	75	85	—	35	25
Absorbed YHR	($0\cdot5 \times 10^{11}$)	1750	—	75	85	40	50	35
	($1\cdot0 \times 10^{11}$)	1000	—	75	85	35	35	35
	($1\cdot5 \times 10^{11}$)	1000	—	75	85	30	17	30
	($2\cdot0 \times 10^{11}$)	1000	—	75	75	30	—	30
Absorbed P 119 B	($0\cdot5 \times 10^{11}$)	750	25	125	150	>250	>250	10
	($1\cdot0 \times 10^{11}$)	1000	—	125	150	250	>250	—
	($1\cdot5 \times 10^{11}$)	1000	—	125	125	250	250	—
	($2\cdot0 \times 10^{11}$)	1000	—	125	100	250	250	—

expected of YHR; the reason for its occurrence with P 119 B is not clear. In all cases a considerable residue of agglutinin for X and Z remains.

Absorption was next carried out with mixtures of various strains. The results are shown in Table VII.

When all three group strains are used simultaneously as absorbing agents the only group agglutinin left in the serum is that for X and Z, which in its turn is removed by the addition of X to the absorbing mixture.

TABLE VII.—ABSORPTION OF V ANTISERUM WITH MIXED SUSPENSIONS.

Serums	Suspensions V	W	X	Z	103 B	YHR	P 119 B
V, diluted 1 in 10 absorbed: 103 B, YHR, P 119 B, each $0\cdot5 \times 10^{11}$	700	—	35	25	—	—	—
V, diluted 1 in 10 absorbed: 103 B, $0\cdot75 \times 10^{11}$; YHR, $0\cdot75 \times 10^{11}$; X, $0\cdot5 \times 10^{11}$	500	—	—	—	—	—	—
V, diluted 1 in 2 absorbed: 103 B, $0\cdot75 \times 10^{11}$; YHR, $0\cdot75 \times 10^{11}$; X, $0\cdot5 \times 10^{11}$	3000	—	—	40	15	50	50
V, diluted 1 in 2 absorbed: 103 B, $1\cdot0 \times 10^{11}$; YHR, $1\cdot0 \times 10^{11}$; P 119 B, $0\cdot25 \times 10^{11}$; X, $0\cdot75 \times 10^{11}$	2500	—	—	—	—	—	—

For complete absorption of this V antiserum it is therefore necessary to use 103 B (group components 1, 2, 3), YHR (group components 1, 2, 4), P119 B (group components 1, 5), and X (group components 1, 2, 6, and possibly others), V has therefore, all six components in its antigen. Of these, component 1 predominates.

Attention has already been drawn to the fall in the titre of the absorbed serum for its homologous organism. The explanation of this seems to be

that the unabsorbed serum acts by virtue both of its group and of its type agglutinins, and has a higher group titre than type titre. After absorption, clumping occurs only to the titre of the type agglutin.

In this connexion the results of an absorption test of the same serum, taken from the rabbit at an earlier stage in the process of immunization, are of interest. 103 B was used as the absorbing agent in a massive dose producing complete absorption.

TABLE VIII.—ABSORPTION OF LOW TITRE V SERUM WITH 103 B.

	Suspension				
Serum	V	W	X	YHR	Z
V, control	1000	25	75	1000	250
V, absorbed 103 B ..	1000	—	20	—	50

As can be seen in Table VIII, the titre of the serum for its homologous organism remained unaffected. It would seem that originally the serum had type agglutinin of as a high a titre as group agglutinin, and that subsequent inoculation of the rabbit led to the production of group agglutinin in excess of type agglutinin. This has been a frequent experience. In general, type agglutinin never reaches a high level, and titres in excess of 2,500 are the exception. Group agglutinin titres, on the other hand, are much higher, and often reach a figure of 25,000.

Some interesting facts have emerged in connexion with the so-called VZ subrace, believed by Andrewes and Inman to contain relatively large quantities of the distinctive Z antigen as well as distinctive V antigen. Three strains were available for investigation, namely VZ Massom and VZ Stansfield, which were used by Andrewes and Inman, and VZ D 427 isolated by Major H. J. Bensted in India. Tested with monospecific V serum prepared as above, and monospecific Z serum prepared along similar lines (see hereafter), the results shown in Table IX were obtained.

It will be seen that the VZ strains contain the type antigen of V, but not of Z. Their Z characters are presumably due to the presence of a large proportion of group component 6 which is found in V, X, and Z strains.

TABLE IX.—AGGLUTINATION OF VZ SUBRACES WITH MONOSPECIFIC ANTISERUMS.

	Suspensions				
Serums	V Oxford	Z Whittington	VZ Stansfield	VZ Massom	VZ D 427
V (monospecific) ..	250	—	125	250	125
Z (monospecific) ..	—	125	—	—	—

B. dysenteriæ *Flexner W* (*Cable*).

The results of the absorption of an antiserum prepared from this strain are shown in Table III.

Except for traces of agglutinin for V, all group agglutinins are absorbed by YHR, which contains components 1, 2, and 4. Component 4 is present

to a well-marked degree, as can be seen by the failure of 103 B to affect absorption. The proportion of component 2 is shown by the difference in the absorptive powers of 103 B (1, 2, 3) and P 119 B (1, 5). It is inconsiderable.

Results obtained with two other different batches of W serum are substantially the same.

In one of these groups agglutinin for V was completely removed, in the others a trace remained. The reason for this occasional incomplete removal of agglutinin for V is not clear, but in view of its complete removal from some batches of serum, it seems doubtful if it can be attributed to the occurrence of specific V antigen in W. Whatever the explanation, the quantity is so small that it has no practical significance.

It will be observed that this particular strain, W Cable, contains a high proportion of group antigen. Recently isolated strains of W are usually poor in group antigen, and would hence be preferable for the preparation of type specific serum for diagnostic purposes.

B. dysenteriæ *Flexner X* (*Hughes*).

Several attempts have been made to analyse the antigen of this type but the results have been unsatisfactory.

Andrewes and Inman remark that X strains can be agglutinated only by X antiserum, and react feebly with antiserums of the group, but that X antiserum has a high titre for the other members of the group. This latter observation refers alike to artificially prepared rabbit antiserum and to the serum of human beings who have been infected with this organism.

The strain X Hughes now appears to be more amenable to group agglutination, and is well agglutinated by the antiserums of the group.

The following points have emerged from investigations made up to date.

X strains are not agglutinated by type specific agglutinins for V, W, Z, 103, P 119, 88, or any of the less common races: they are, however, clumped by group agglutinin, some strains reacting better than others in this respect. X Hughes produces an antiserum of high titre which is rich in group agglutinin, all of which is completely absorbed by the homologous organism. When absorbed as far as is possible with either 103 B or YHR, the titre of the serum for X is reduced to a low level, and varying amounts of group agglutinin remain, particularly for Z. The antiserum may in fact be left by this procedure with a higher titre for Z than for X. Absorption with 103 B and YHR, *plus* Z, gives a serum with a relatively low titre for X and an appreciable residue of group agglutinin. It has not yet been possible to produce a satisfactory mono-specific antiserum.

It seems highly probable that difficulty has arisen because the cultures used for making X antiserum were group variants poor in type antigen.

A number of freshly isolated strains have recently been procured from India, and further investigations are being pursued.

It may, therefore, be concluded provisionally that X contains a distinctive type antigen, and group components 1, 2, and 6. Further investigations may supplement this list, and permit of the production of a pure monospecific serum.

B. dysenteriæ *Flexner Z* (*Whittington*).

Unlike antiserums prepared from V, W, and X, that prepared from Z contains relatively insignificant quantities of group agglutinin. A summary of absorption tests is shown in Table X.

TABLE X.—ABSORPTION OF Z ANTISERUM WITH GROUP ANTIGEN.

Serum	Suspensions V	W	X	Z	103 B	YHR	P119B
Z (diluted 1 in 2), control	—	—	75	2500	200	300	75
Z (diluted 1 in 2), absorbed 103 B (1×10^{11})	—	—	50	1000	—	—	—
Z (diluted 1 in 2), absorbed YHR (1×10^{11})	—	—	50	1000	—	—	—
Z (diluted 1 in 2), absorbed P119B (1×10^{11})	—	—	50	1000	50	25	—
Z undiluted, absorbed: 103 B, 1×10^{11}; X, $0{\cdot}25 \times 10^{11}$	—	—	—	2500	10	10	—

Absorption is equal with 103 B and YHR, and less complete with P 119 B. From this it would appear that group components 1 and 2 are present. Agglutinin for X remains, and this can be removed by absorption with X, or with "VZ." This is presumably due to the presence of component 6. The group components present in Z are, therefore, 1, 2, and 6.

Type 103.

It has already been shown (Table II) that 103 B, which contains group components 1, 2, and 3, effects complete absorption of group agglutinin from the antiserum prepared from the parent strain.

Type P 119.

From this type also there has been isolated a group variant which contains all the group antigen found in the present strain (see Table IV). It contains components 1 and 5.

Type 88 *and the Newcastle-Manchester Bacillus.*

The close relationship which exists between Type 88, found in India, and the Newcastle bacillus (Clayton and Warren, 1929*a*, *b*), and the Manchester bacillus (Downie *et al.* 1933), found in the United Kingdom, was first pointed out by Scott (Whitehead and Scott, 1934). Two strains of 88, originating from Poona, form Sartorius' Group L.

The rather striking range of biochemical reactions shown by these different strains is set out in Table XI:—

TABLE XI.—BIOCHEMICAL REACTIONS OF TYPE 88, MANCHESTER BACILLUS, AND NEWCASTLE BACILLUS.

	Lactose	Glucose	Mannitol	Dulcitol	Sucrose	Indole
Type 88 (33% of strains)	—	Acid	Acid	—	—	—
Type 88 (66% of strains)	—	Acid	Acid	Acid (late)	—	—
Manchester bacillus	—	Acid and gas	Acid and gas	Acid and gas (late)	—	—
Newcastle bacillus	—	Acid and gas	—	Acid and gas (late)	—	—

About one-third of the strains of 88 isolated in India have biochemical reactions identical with the Flexner races. The remaining two-thirds produce acid in dulcitol after some days' incubation.

The Manchester bacillus produces acid and gas in glucose, mannitol, and dulcitol, the reaction in dulcitol being delayed. Newcastle bacillus produces acid with a bubble of gas in glucose, and after some days may have the same action on dulcitol.

It is to be noted that all strains of these organisms so far found are consistently indole-negative, whereas most strains of the V-Z series produce indole.

TABLE XII.—ABSORPTION OF 88 ANTISERUM WITH GROUP ANTIGEN.

	Suspension							
Serum	88	V	W	X	Z	103 B	YHR	P119B
88, control	1250	50	500	400	400	2500	5000	1250
88, absorbed 103 B (1×10^{11})..	1250	30	25	—	—	—	10	—
88, absorbed YHR (1×10^{11})..	1250	—	—	—	—	—	25	—
88, absorbed P 119 B (1×10^{11})	1250	50	50	50	50	250	600	50

TABLE XIII.—ABSORPTION OF NEWCASTLE ANTISERUM WITH GROUP ANTIGEN.

	Suspensions								
Serum	New.	88	V	W	X	Z	103B	YHR	P119B
Newcastle, control	1000	1500	125	50	250	250	1000	1000	125
Newcastle, absorbed YHR (2×10^{11})	1000	1000	—	—	—	—	—	—	—
Newcastle, absorbed 103 B (2×10^{11})	1000	1000	—	—	—	—	—	25	—

In spite of these very diverse and, in the case of the Manchester and Newcastle bacilli, undysentery-like biochemical reactions, the antigen of these three strains is identical. Each is capable of robbing the antiserums of the others of all their agglutinin.

The close antigenic relationship of 88 to the Flexner group was noted when the organism was first described. A similar serological relationship was found in the Newcastle bacillus by Clayton and Warren. This is confirmed for both by absorbing their antiserums with 103 B and YHR (see Tables XII and XIII). Each is in this way shown to possess Flexner group components 1 and 2, and possibly also 4.

Tests carried out with two other batches of 88 antiserum of different origin gave similar results. In both cases YHR effected virtually complete absorption of group agglutinin, whereas 103 B left a residue for V and W.

The group agglutinin in this particular Newcastle antiserum is completely removed by both 103 B and YHR, but in another serum which was tested, a residue of agglutinin for V and W remained after absorption with 103 B, while absorption with YHR was complete.

From a consideration of all these data, it seems clear that 88 and the Newcastle-Manchester bacilli are of one antigenic type, which embraces a number of strains showing varied biochemical reactions. The non-dulcitol-fermenting form of 88 has all the characters—morphological, biochemical, serological—of the Flexner group, and it is possible that this is the original form from which have been derived strains showing variation in biochemical reactions, but maintaining an unchanged antigenic structure.

Types 170, *P* 288, *P* 274, *D* 1, *D* 19, *and P* 143.

These types, with two possible exceptions, do not show any appreciable degree of cross-agglutination either with each other or with any of the types previously described. This character has persisted through some six years of artificial culture, and may be taken to indicate a complete absence of the group antigen common to the Flexner group.

As exceptions to the above general statement, antiserums prepared from certain strains of P 288 and P 143 have shown a limited but suggestive degree of cross-agglutination with the Flexner group. It has not yet been possible to investigate this fully.

Cross-agglutination occurs between P 274 and *B. alkalescens* (Andrewes), and Aoki VII (received from N.C.T.C.). Both *alkalescens* and Aoki VII are agglutinated by P 274 serum to its full titre. Each removes its own agglutinin from P 274 antiserum, but leaves behind agglutinin for the homologous organism. Similar results have been found with certain gas-forming coliform organisms whose exact nature is unknown. There is little evidence to suggest that *B. alkalescens* and these gas-forming strains are capable of producing dysentery, and their relationship to P 274 is, therefore, of considerable interest.

Précis of Results.

The results of this analysis are summarized in Table XIV.

It will be seen that V, W, X, and Z, together with 103, P 119, and the 88-Newcastle-Manchester bacilli, contain both type and group antigen. Each has a distinctive type antigen peculiar to itself, which is not shared, even in the minor degree suggested by Andrewes and Inman, with any of the other strains: all contain the principal component of the group antigen: and the minor group components are scattered through the different types, each occurring in some and not in others. In contrast to these seven types, the remaining types shown in Table I each have a distinctive type antigen, but do not contain Flexner group antigen.

A considerable number of freshly isolated strains have been tested

TABLE XIV.—ANALYSIS OF ANTIGEN IN THE MANNITOL-FERMENTING DYSENTERY ORGANISMS.

Organism	Type antigen	Group antigen components
V and VZ	Specific	1, 2, 3, 4, 5, 6
W	,,	1, 2, 4
X	,, (?)	1, 2, 6 (?)
Z	,,	1, 2, 6
103	,,	1, 2, 3
P 119	,,	1, 5
88 / Newcastle / Manchester	,,	1, 2, 4
170	,,	Nil
P 288	,,	Nil (?)
P 274	,,	None of the above group components
D 1	,,	Nil
D 19	,,	Nil
P 143	,,	Nil (?)

with type-specific serums from which group agglutinin has been absorbed. All fall clearly into one type or another, and none has been found to contain more than one type antigen. It has not been possible to confirm in the same extensive way the details of the analysis of group antigen components. In making this analysis only a limited number of strains (from one to three) of each type was used. It is possible that more extensive investigations may reveal differences in the quantity and arrangement of the minor group elements in certain of the types. Something of this kind has been seen in the V and so-called "VZ" strains. Differences of this nature are, however, unimportant and are not at variance with the general principles which have been enunciated.

Classification.

Reasons have already been given for regarding the possession of group antigen as a character of fundamental significance, indicating close relationship among the organisms in which it occurs. On these grounds the various types fall naturally into two groups. One comprises the seven organisms in which Flexner group antigen occurs. The other, which can only be provisional, embraces those strains which have the biochemical reactions of the Flexner bacilli but which lack Flexner group antigen.

It is already generally accepted, although on somewhat different grounds to those now put forward, that V, W, X and Z are closely related members of one group. There is little doubt that 103 is identical with one or other of the original Y strains, and that it was overlooked by Andrewes and Inman because variation had previously occurred in those strains they examined; in consequence of this the specific element was missed and the variants were grouped with Y Hiss and Russell, itself a variant of W. Dr. W. M. Scott informs me that 103, which he believes to be identical with the original Lentz Y, is fairly common both in the United Kingdom and in other parts of the world. It occurs in Sartorius

and Reploh's series where it is classified as Y 2. It has been recovered from Army cases in Egypt as well as India. Although P 119 does not appear to have been described previously in the literature of this country, it is not a newcomer, for it is identical with group G of Sartorius' series, which embraces two strains from Poona, eleven strains from Lagos, and Nos. IV and XII in Aoki's series. P 119 shows well-marked cross-agglutination with the members of the V—Z series, and is therefore liable to be classed as a weakly agglutinating "Flexner" organism by anyone using only unabsorbed polyvalent serum for its identification. This, coupled with its apparent rarity in Europe, may account for the fact that it has been hitherto overlooked.

The only type whose introduction into this group may be regarded as controversial is the Newcastle-Manchester bacillus, which differs from the others in its biochemical reactions. It is, however, considered that the gap between these strains and the other members of the group is bridged by 88, which, while it has an antigenic structure identical with the Newcastle-Manchester organisms, has also the typical biochemical reactions of the Flexner group. It is considered that under these circumstances the evidence of relationship provided by the antigenic structure should over-rule the less important irregularities of biochemical reaction.

It is suggested that this group of seven organisms should be regarded as an extended edition of the familiar Flexner group, and should retain the name. The additional members should, for purposes of identification, either be accorded further letters of the alphabet (103 has a strong lien on the letter Y) or, preferably, all seven should be accorded roman numerals.

Little is at present known regarding the antigenic structure and relationship of the six types which make up the second group. Their distinctive type antigens make them easy to identify, and observations made in the six years since they were first recognized leave no reasonable doubt that they can cause dysentery.

The placing of these antigenically unrelated organisms in one group is a provisional measure which has little to justify it other than the general similarity of their biochemical reactions. Even this feature is inconstant, as four of them—P 288, P 274, D 1, and D 19—are occasional late fermenters of dulcitol, though it is doubtful if this is of much significance. The relationship borne by one of these strains (P 274) to other organisms which apparently do not cause dysentery requires further investigation, and may ultimately lead to its removal from this group.

Summary.

(1) Group variants devoid of type antigen, described in the previous section, provide material for ascertaining the various components of the antigen in the mannitol-fermenting dysentery bacilli.

(2) Flexner Y, as defined by Andrewes and Inman, is not a valid type. The strains which are regarded as being of this type, such as Y Hiss and Russell and Y Lentz, are old strains which have lost their type antigen and possess only group antigen. The reason why many newly isolated strains are identified as Y is because the antiserums used for their recognition contain more group than type agglutinin.

(3) The four Flexner types, V, W, X and Z, each possess a distinctive type antigen and share a complex group antigen. They do not, as suggested by Andrewes and Inman, possess minor quantities of each other's type antigen.

(4) 103, P 119, and the 88-Newcastle-Manchester series have also distinctive type antigens, and share the same group antigen with V, W, X and Z.

(5) It is considered that the existing Flexner group should be extended to include all organisms which have a type-specific antigen and share this common group antigen. The three types in (4) should therefore be placed in the group and named accordingly.

(6) Six types which have the biochemical reactions of the Flexner group, and which have individual type antigens but no Flexner group antigen, are provisionally placed in a separate loose group.

ACKNOWLEDGEMENTS.

I have to thank Major-General H. Marrian Perry, C.B., O.B.E., K.H.S., Director and Professor of Pathology, Royal Army Medical College, for affording me every facility for carrying out this work: Dr. W. M. Scott, Ministry of Health, for much helpful advice and for giving me subcultures of many of his strains: and my many colleagues in India and Egypt for supplying me with large numbers of freshly isolated cultures.

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Editorial.

THE STATE OF THE PUBLIC HEALTH.

In the December number of the Journal, 1938, we gave some notes on sections of the Report by the Chief Medical Officer to the Minister of Health. The following notes refer to other sections for which we had not space in the December issue.

Whooping-cough still remains an important source of child mortality. The evidence of the value of any vaccine in preventing an attack is conflicting, and it is thought that the verdict must rest upon the reaction observed in a large number of immunized persons exposed to infection. The results of the use of a vaccine in controlling paroxysms and shortening the attack have been disappointing.

There was a substantial rise in the incidence of poliomyelitis and polio-encephalitis. One or more notifications were received from every county in England with the exception of Lincoln and the Soke of Peterborough. The condition is apt to be overlooked unless paralysis occurs as the initial forms in mild cases are indistinguishable from certain other infectious diseases.

It has been found that muscles re-educated in an orthopædic hospital improve more quickly than muscles allowed to recover spontaneously. At four to six months it is possible to determine the ultimate degree of recovery with fair accuracy.

The Chief Medical Officer considers encephalitis lethargica to be an independent disease. From the clinical point of view three types are distinguished: (1) General disturbance of the functions of the central nervous system, but without localization; (2) various localizations in the central nervous system; (3) mild or abortive cases.

In each single epidemic certain types predominate, e.g. in one epidemic the lethargic-ophthalmoplegic type prevails, in another the bulbar paralytic, amyostatic, or hyper-kinetic. They might be considered different diseases were it not for their simultaneous appearance in one and the same epidemic. When encephalitis lethargica first appeared in Vienna and in this country the predominant type was the somnolent-ophthalmoplegic type, a lesion in or near the third nerve nucleus; von Economo considered this type should be regarded as the basic form of encephalitis lethargica. This view is supported by Sir Arthur MacNalty.

The maternal mortality rate for the year per 1,000 total births was 3·13—for puerperal sepsis 0·94 and for other cases 2·19. There has been a fall in the rate in each of the last three years, a rate of 3·94 for 1935 and 3·65 for 1936. The rate expressed per 1,000 live births which admits

of a comparison with each year from 1911, when the present classification was introduced, is 3·26, the lowest record during that period.

The limited use of consultants was commented upon in last year's report, and there appears to be no great change in the position. In only 129 of the 1,817 fatal cases were consultants called to patients who were not in hospital.

During 1937 important innovations have been made in the Insurance Medical Service. The medical benefits of the National Health Insurance have been extended to cover all young persons over the school-leaving age who become insurably employed, thus closing the gap which had existed between the medical supervision afforded by the School Medical Service and that available under the Insurance Medical Service which hitherto only became effective in the case of persons of 16 years and upwards. A great extension has been made of the scheme of post-graduate courses for medical practitioners. Under this larger scheme, which will apply to practitioners irrespective of where they practise, it is intended that they shall be able to obtain a free course once in every five years. Within specified limits not only will the fee of the course be paid, but also travelling and subsistence costs, and the cost of a whole-time locum tenens where one is required.

In 1937 the number of insured persons entitled to medical benefit in England and Wales was 17,032,000, and the number of insurance practitioners was 16,800—increases of 712,000 and 50 on the previous years. The total cost of medical benefit, exclusive of the cost of administration, was £10,436,000, of which £7,914,400 represented the doctors' remuneration, and £2,251,600 the cost of medicines and appliances. In 1937 alone, the sum of £2,488,000 was expended from the disposal surplus of approved societies for additional treatment benefits, of which the most important are dental and ophthalmic benefits.

In 1937 the number of deaths notified to be due to tuberculosis was 28,529, compared with 28,268 in 1936. The considerable fall in pulmonary tuberculosis which has been so satisfactory in recent years did not occur in 1937; this was probably asssociated with the epidemic of influenza which occurred at the beginning of the year.

For the first time for many years an increase in the mortality from non-respiratory forms of tuberculosis is recorded. In 1936, 4,467 deaths were recorded from non-respiratory tuberculosis; in 1937 the deaths were 4,559. The significance of this increase cannot be assessed until further data become available. The standard death-rate for non-respiratory tuberculosis has been halved since 1921; the rate of decline from year to year has been erratic, varying from 10 to 2 per cent. It is possible that the small increase in 1937 may not be of great significance.

The Tuberculosis Service continues to make progress. More use is being made of the Dispensary Service; 110,809 new cases were dealt with in 1937, the highest number on record. Most of the cases were referred to the dispensary by medical practitioners.

The primary need of the Tuberculosis Service is to get into touch with patients at an earlier stage of their disease. It is hoped that the intensive educational campaign carried out under the auspices of the Ministry in 1938 will succeed in inducing patients to seek medical advice at a much earlier stage of the disease. A higher proportion of the tuberculous population is now willing to accept treatment in residential institutions, where there are greater facilities for treatment and an improved standard of comfort. Unfortunately there is little evidence of a marked increase in the number of patients who take advantage of the facilities for treatment at a stage of the disease when recovery is most probable. On the other hand there is distinct evidence that a greater number of patients are willing to remain in hospital until the end of life. This is an important fact from the public health point of view.

Sir Arthur MacNalty thinks that we are now suffering from a wave of over-enthusiasm in the matter of thoracic surgery, and are in danger of losing our sense of proportion. The surgical treatment should be carried out by a surgeon who has had considerable special training, not only in surgical technique but also in phthisiology. The nursing staff should be thoroughly experienced in the special work. For these reasons the provision of arrangements for thoracic surgery at the smaller sanatoria has been discouraged. The provision of a small number of thoracic units each able to meet the needs of a number of areas appears to be the most efficient way of providing for this particular class of work.

In 1937, Dr. Stanley Griffith read a paper on bovine infection in human tuberculosis. He said that at the Congress in Washington, held in 1908, Koch maintained that up to date in no case of chronic pulmonary tuberculosis had bovine bacilli been definitely demonstrated. Within a few months Griffith obtained pure cultures of bovine bacilli from the sputum of two men in England. Up to 1922 only four cases had been discovered in this country, when the finding by Munro of two bovine strains from sputum among 100 strains of tubercle bacilli collected for serological tests stimulated inquiry into the subject. In Denmark, Jensen found bovine bacilli in 88 out of 1,774 pulmonary cases. The regional percentage corresponded directly with the prevalence of tuberculosis in cattle. In Holland, Ruys found bovine bacilli in 13 of 204 adult cases. In 1937, Griffith was able to record 163 instances of bovine infection among more than 5,000 type determinations made by himself and other workers in England, Scotland, and Wales. In 62 of the 163 cases of bovine phthisis the clinical and pathological evidence was in favour of the alimentary

tract as the portal of entry of the bacilli. It was concluded that in Great Britain ulcerative pulmonary tuberculosis due to bacilli of the bovine type is, in a large proportion of the cases, the final phase of infection acquired in childhood, or in adolescence, or even in adult life, through the consumption of infected milk. Of the remaining 101 cases, 25 had come in contact with cattle in their employment. Inquiry of these cattle contacts showed that a large number of tuberculous persons with tubercle bacilli in the sputum are employed in the milk industry.

No striking changes occurred in the working of the venereal diseases scheme in 1937, but it is thought that the year may be noteworthy in the treatment of gonorrhœa by sulphonamide compounds.

The treatment centres deal with more than 85 per cent of fresh infections of syphilis. Using this figure as a basis for calculation, the number of cases dealt with by treatment centres, other institutions and private practitioners would be approximately 6,600 or 1·6 per 10,000 of the population. There appears to be very little tendency in this country for males to neglect seeking advice for syphilis presenting any external manifestations. In the five years 1933 to 1937 the ratio of primary to secondary syphilis was 1 to 0·47, in 1921 for every male who attended at a treatment centre at least one other had delayed action until the outbreak of secondary signs.

The number of early cases of gonorrhœa represents a rate of 8·4 per 10,000 of the population of England and Wales. The figures show a slight increase over those for 1936, but this may be due to a larger proportion of the infected resorting to the treatment centres. The figures for the cases dealt with at the centres represent a rate per 10,000 which is much lower than that in Denmark and in Sweden, where anti-venereal measures are very active, and as far as syphilis is concerned most successful. The rate for gonorrhœa in Sweden was 17·9 per 10,000, and in Denmark 27·0 per 10,000.

During the year numerous observers have suggested that the sulphonamide group of compounds may be specific for gonorrhœa and quickly render patients non-infective. Continental workers have suggested that "uleron" (a di-sulphonamide) may act more rapidly and certainly than does sulphanilamide. Most of the researches in England in 1937 have been made with para-amino-benzene-sulphonamide, commonly known as sulphanilamide. Success has also been claimed for 2-(p.-amino-benzene-sulphonamide), pyridine. It is considered too early to express a definite opinion on the merits of these compounds and more requires to be known of their toxic effects. They appear to have value in those cases in which there is evidence that the height of the attack has been passed and the tissues are exerting a strong resistance to the gonococcus. The

best course is not to give the remedy until the disease has lasted two or three weeks.

It seems possible that this form of treatment may be assisted by preparing the patient with some protein shock therapy, or by giving him a course of vaccine treatment before starting the administration of the sulphonamide preparation. But there is the danger that overdoses of vaccine may have the opposite effect and lower the resistance of the patient.

The two chief causes of the present incidence are failure to seek skilled advice for venereal disease and premature discontinuance of attendances at the centre. It is probable that the numbers being brought under treatment are too few, especially in the case of women with gonorrhœa and to a less extent of those with syphilis. In the case of men with gonorrhœa, also, the numbers seeking treatment are much below those which one would expect from the ratio of gonorrhœa to syphilis in the Army, where concealment of venereal disease is a crime.

Recently agitation for a reconsideration of compulsory measures for dealing with venereal disease has been roused by the publication of a report by a New York Commission which visited England, Denmark, Norway and Sweden. The report showed that in the Scandinavian countries a considerable measure of success had been obtained in reducing the incidence of syphilis. This success was attributed to the fact that in Denmark, Norway and Sweden there are laws under which persons suffering from any of the three principal venereal diseases can be compelled to undergo treatment. In 1937 the Minister of Health and the Secretary of State for Scotland appointed a mission to visit Denmark, Sweden and Norway, as well as Holland, to study the anti-venereal measures in each of these countries. Holland was chosen as there are no compulsory measures there and it was felt that it might serve as a control on the inferences drawn from changes in the incidence in the three countries which place reliance on compulsory measures.

One of the objections to compulsion has been the fear that it might lead to the concealment of disease. The mission could find no evidence that the operation of the law had led to concealment of disease to any appreciable extent or imposed undue hardship on the people. In each of the countries the authorities have been able to secure a sufficient degree of co-operation by infected persons to achieve a considerable success in reducing the incidence of syphilis. On the other hand none of the countries has been outstandingly successful in reducing the incidence of gonorrhœa. Considering that in the countries employing compulsory treatment and in those which rely on a voluntary system the degree of success in reducing the incidence of syphilis and of relative failure in gonorrhœa are broadly similar, compulsory treatment did not seem to the

mission to be a major factor influencing the results of the anti-venereal measures in the countries where it is employed.

Much work has been done in the year under review on the important subject of nutrition. It is the Ministry's task to keep in touch with all new knowledge and to evalue it with the assistance of experts. Here the Ministry's Advisory Committee on Nutrition under the Chairmanship of Lord Luke renders important services. The activities of this Committee during the past year have been mainly concerned with three investigations. These are: (*a*) Family budget inquiry; (*b*) distribution of the population of Great Britain into income groups; (*c*) quantitative dietary surveys. The dietary survey in the West Riding of Yorkshire was completed early in 1937. But before the results can be published further computations will be required in view of recent discussions on the man-value co-efficients hitherto employed in dietary surveys. In Cathcart's scale women and children are expressed as fractions of the adult man taken as unity; thus a child of 12 to 14 years is considered as 0·9 of a man. Recent work has, however, shown that a child of 12 to 14 years requires about 90 grammes of protein per day for adequate nutrition, whereas the needs of the adult male are in the region of 70 grammes per day. On the basis of protein requirements a child of this age would be regarded as 1·3 of a man instead of 0·9 on Cathcart's scale.

The results of the tests of physical efficiency carried out at the Carnegie Physical Training College, Leeds, showed an absence of any definite correlation between the resting pulse-rate and height, weight or dynamometer pull, so that within the population studied the pulse-rate was independent of physique and muscular strength. The most constant feature of the response of the pulse-rate to exercise was that the rate returned to pre-exercise level in forty-five to sixty seconds after the cessation of the exercise. But even assuming that this range might be taken as a criterion of physical fitness, it was considered that the test could not be employed in the routine examination of school children as it requires more time than School Medical Officers can usually devote to it.

The inquiry of the Nutrition Milk Committee in regard to the relative value of raw and pasteurized milk showed that there were no constant differences between the growth rates of children receiving raw milk and those of children receiving pasteurized milk.

With regard to the methylene-blue reduction test the intention of the regulations is to secure that the *milk when delivered to the consumer* shall comply with a prescribed bacteriological standard. Testing milk immediately after production does not afford clear distinction between good and bad methods of production. Lapse of time is necessary for the difference to become bacteriologically obvious.

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The inquiry of the Nutrition Milk Committee in regard to the relative value of raw and pasteurized milk showed that there were no constant differences between the growth rates of children receiving raw milk and those of children receiving pasteurized milk.

With regard to the methylene-blue reduction test the intention of the regulations is to secure that the *milk when delivered to the consumer* shall comply with a prescribed bacteriological standard. Testing milk immediately after production does not afford clear distinction between good and bad methods of production. Lapse of time is necessary for the difference to become bacteriologically obvious.

The Report of the Committee on Cattle Diseases pointed out that the ncidence of tuberculosis in different herds, often within small areas, might range from complete freedom to 100 per cent infection, and in the view of the Committee the generally accepted conclusion that 40 per cent of cows in dairy herds in this country are infected with tuberculosis did not appear exaggerated. From the evidence the Committee considered that at least 5 cows per 1,000 yielded tuberculous milk, but as a result of the mixing of infected milk with other milk, a much larger percentage of the samples from individual herds proved to be infected. The view that a few tubercle bacilli in milk are permissible for their possible immunizing value is based on a definitely disproved belief that bovine bacilli are less virulent for man than bacilli of the human type.

The Ministry and the Medical Research Council have respectively affirmed that random and uncontrolled immunization which involves over 2,000 deaths per annum and a large and unknown amount of invalidity cannot be justified in any circumstances. Fortunately efficient pasteurization affords a simple means of rendering milk containing tubercle bacilli safe for consumption.

In Sir Arthur MacNalty's report references are made to the most important defects in the construction of pasteurizing plants and to the points to be observed in their supervision.

Evidence of the practical value of the phosphatase test continues to come from many parts of the world. A positive phosphatase test affords proof of inefficient pasteurization and it should be frequently applied to samples of pasteurized milk in addition to the plate count. The plate count is affected by the conditions to which the milk is subjected after pasteurization.

The Livestock Industry Act, 1937, came into force during the year and has an important bearing on the future of the meat industry. The Act empowers the Livestock Commission to select sites for and set up three experimental civilian slaughter-houses and upon payment of compensation to close some or all of the slaughter-houses within a prescribed distance of the central slaughter-house. The location of the central slaughter-houses and the areas they will serve, have not yet been settled, but the ultimate aim is the establishment of suitably situated central abattoirs. With the disappearance of the small private slaughter-houses meat inspection will be facilitated and the conditions which make inspection in country districts difficult will disappear.

During the last few years considerable prominence has been given to the presence of fluorine in water and in food. It has been known for a long time that fluorine given to animals gives rise to severe affections of the bones and teeth.

In 1931 it was found that mottled teeth, a disease occurring sporadically in many localities in the world, was due to the presence of fluorine in the water supply in amounts of two or three parts per million. In these mottled teeth the enamel becomes dead white and opaque and brown stains appear on the surface.

Public water supplies, with the exception of one area in Essex where mottled teeth occur, seem to be tolerably free from fluorine. There is, however, the possibility that phosphate manures which often contain 3 or 4 per cent of fluorine may lead to the contamination of water especially from shallow wells. It has also been shown that plants can take up fluorine from the soil. It would seem that the chief danger may be in the increasing use of fluorine compounds, such as barium fluosilicate and powdered cryolite as agricultural insecticides. Experiments have shown that fruit after repeated spraying with barium fluosilicate may contain three to six parts of fluorine per million. Fluorides are also widely used as constituents of glazes and enamels, some of which are attacked and dissolved by acid foods. The Committee on Preservatives in Food in 1924 reported specifically and adversely on the addition of fluorides to food; the presence of added fluorides in food is an infringement of the Preservatives in Food Regulations.

It is more difficult to perform the canning of vegetables than that of fruits, and for proper sterilization pressure cookers are required. This is necessitated by the fact that all vegetables may be heavily contaminated with sporing soil organisms including the *Clostridium botulinum*. The growth of this organism and the formation of its toxin is inhibited by acid foods such as fruits and tomatoes; for sterilizing non-acid foods steam-pressure cookers are required to destroy the spores and so ensure that no subsequent bacterial growth will take place.

A new function has been added to the responsibilities of the Ministry. In the House of Commons the Home Secretary announced on June 1, 1938, that to the Ministry of Health had been assigned the responsibility for dealing with questions relating to the provision of hospitals in England and Wales for the treatment of air raid casualties in the event of hostilities, and the Department of Health had assumed corresponding functions in Scotland. A special section of the Medical Department of the Ministry in charge of Dr. J. H. Hebb has been set up. This section works in close relation with the corresponding administrative branch. In anticipation of this new service a survey of hospital accommodation throughout England and Wales was made early in 1938. Medical and other officers of the Ministry have been assigned to various districts in the country in order that they may maintain close touch with local authorities and the authorities of voluntary hospitals in preparing schemes which can be put into operation immediately if required.

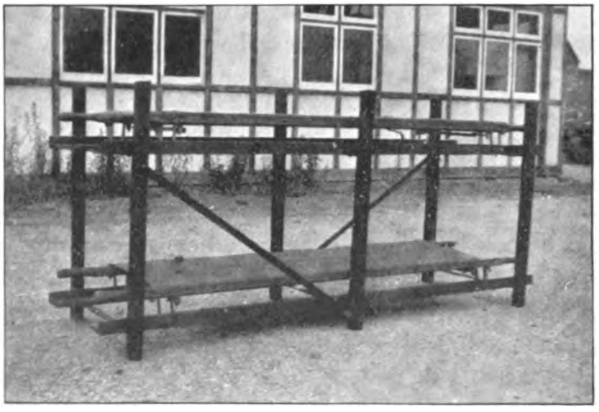
Clinical and other Notes.

IMPROVISED STRETCHER RACK FOR LORRIES AND RAILWAY VANS.

By "THE QUARTERMASTER."
Hereford Branch, British Red Cross Society.

When drawing up the plans for Air Raid Precautions for our Voluntary Aid Detachments the question of transport of stretcher cases presented some difficulty owing to the small number of ambulances available.

After many trials the stretcher rack shown in the sketch was evolved, and found to be most satisfactory. It can be made rapidly by any village carpenter and can be erected in a lorry in fifteen minutes. Trials proved its rigidity and comfort, and it was then tried as a fitting for railway vans, with the modification that an extra tier was added to take a third stretcher. Four such frames will fit into a covered van which can be adapted in less than one hour to take twelve stretcher cases. No other fitting known to the writer can be improvised and fitted so rapidly, or which is so comfortable for the patient. Owing to the economy of space there is room in the van for an attendant and several sitting cases as well.



The rack consists of six uprights of 2 by 4 inch timber braced diagonally with $1\frac{1}{4}$ by $\frac{3}{4}$ inch iron strips. The uprights are connected by two bent iron strips of the same dimensions and upon these are laid 4 by $\frac{3}{4}$ inch planks, with a fillet 2 by $\frac{3}{8}$ inch at the outside edge upon which the stretchers rest. All these components are drilled for $\frac{3}{4}$ inch bolts and the whole can be assembled in less than fifteen minutes.

It is not necessary to bolt the rack to the floor of the lorry as its weight, especially when loaded, and rigidity render it sufficiently stable.

The rack for the railway van is of the same construction, but has another tier made in the same manner.

NOTE BY LIEUTENANT-COLONEL T. B. NICHOLLS, R.A.M.C.

This stretcher rack was demonstrated during an inspection of the Hereford Voluntary Aid Detachment, and proved to be most suitable for its purpose. It is easily made, rapidly fitted and is stable and comfortable. As applied to railway vans it appears to be the most suitable apparatus yet devised for the preparation of improvised ambulance trains, as it is strong, rigid and very economical of space.

The Quartermaster who devised this useful rack was persuaded to prepare this article, as it was considered to be of general interest.

A CASE OF DEPARTURE FROM THE NORMAL IN THE ROTATION OF THE GUT.

BY MAJOR F. J. O'MEARA,
Royal Army Medical Corps.

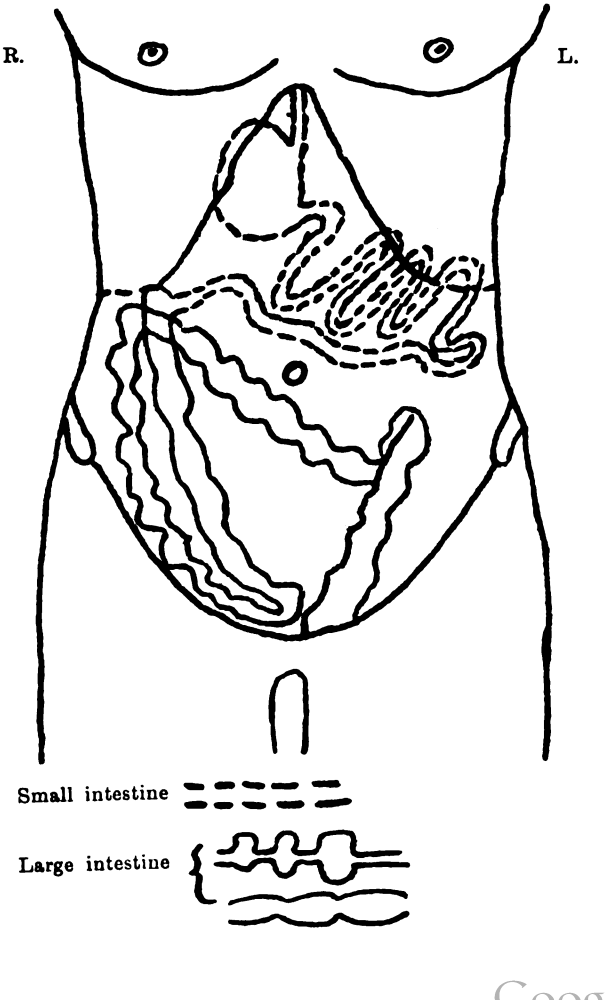
THE following note is written to place on record an example of transposition of the stomach during development. The mid and hind gut were also involved, to a lesser degree, in the mal-position of the bowel in the abdomen. There was no transposition of other viscera. A radiogram of the chest showed the normal position of the heart, with the apex beat to the left, as indicated by clinical examination. The radiograms of the abdomen showed the liver in its normal position.

Rifleman R. was admitted to the British Military Hospital, Meerut, in January, 1938, for investigation for dyspepsia. The stool was negative for occult blood and a fractional test meal was within normal limits. Radiograms of the abdomen after a barium meal showed the disposition of the stomach, small and large intestine as described below. The meal had passed out in twenty-four hours, leaving no residue. A barium enema was subsequently given, but as the patient was not screened during its entry into the bowel, I am still uncertain of the exact position of the anatomical divisions of the large bowel. The following sketch is a composite picture from the radiograms demonstrating, as far as I have been able to ascertain, the component parts of the alimentary canal in the abdomen. The stomach was to the right. The small intestine occupied the left side of the abdomen above a line passing through the 9th right costal cartilage, umbilicus and anterior superior spine of the left ilium. The large intestine occupied the right side of the abdomen and the pelvis below this line.

The position of the alimentary canal in the abdomen was as follows:—

Name		Extent	Position in Rifleman R.'s abdomen
Fore-gut ..	..	Stomach and duodenum to ampulla of Vater	Stomach in the epigastrium rotated to the right. Duodenum to the left of the vertebral column
Mid-gut ..	..	Ampulla of Vater to the junction of the middle with the left third of the transverse colon	The small intestine filled the upper part of the left side of the abdomen. The ileum opened into the cæcum on the right side of the abdomen beneath the right lobe of the liver. The cæcum and ascending colon descended into the pelvis and looped back along the right flank. The deeply haustrated bowel is considered to be transverse colon. This ascended to form a second loop below the right lobe of the liver and then passed diagonally across the abdomen to the left iliac fossa
Hind-gut ..	..	Left third of the transverse colon, descending, iliac and pelvic colon and rectum	The colic angle had remained in relation to the superior mesenteric artery and had not ascended to form the splenic flexure. A loop of large bowel lay in the left iliac fossa. The remainder of the large bowel being in the pelvis

COMPOSITE DIAGRAM.



To those inspired "to seek out the secrets of nature" the excellent description of the complicated mechanism of the rotation of the gut in the "Synopsis of Surgical Anatomy," by A. L. McGregor (John Wright and Sons, Ltd., Bristol), is recommended. Without the assistance of Mr. McGregor's book this case could not have been recorded.

My thanks are due to Colonel K. Comyn, Officer Commanding, British Military Hospital, Meerut, for permission to submit this record for publication.

URINARY GLUCOSE IN PREGNANCY.

By Major C. R. CHRISTIAN,

Royal Army Medical Corps.

The renal threshold for glucose, or leak-point of the kidney, is that level of blood-sugar above which glucose appears in the urine. The normal threshold is about 180 mgm. glucose per 100 c.c. blood. The amount of blood-sugar in the normal individual does not rise above this level; hence the urine is sugar-free.

The threshold for glucose, however, may vary in different individuals in health and disease. Thus certain people who have a low threshold may exhibit glycosuria although the blood-sugar is normal and such people are apparently healthy. This is termed renal glycosuria, the cause of which is uncertain.

Although a temporary lowering of the renal threshold in pregnancy is not a fresh discovery, most textbooks say little or nothing of this matter. It is not of uncommon occurrence and its true nature is not always recognized by medical officers occasionally in charge of families. It is hoped, therefore, that the following notes of cases which were dealt with at the Military Hospital, Colchester, may be of interest.

Case 1.—Mrs. Fr., aged 24. Primigravida 7 months.

Previous health very good. The patient looks and feels well and is well nourished. On further questioning she complains of slightly increased thirst and micturition and a mild pruritus vulvæ, but has not reported these symptoms which have only lasted for a few weeks. There are no signs or symptoms of thyroid, pituitary or adrenal disease. Glucose is present in considerable quantity in the urine, as shown by the fermentation of yeast. The history of the case is as follows:—

The urine had been examined during the fifth and sixth months of pregnancy and no sugar found. In the seventh month the urine contained considerable glucose; no ketone bodies, albumin or casts were found; specific gravity 1030. A few days later the glucose tolerance test was

carried out with 50 grammes of glucose by the mouth and gave the following results:—

Fasting blood	68 mgm. glucose per 100 c.c. blood
½ hour after glucose given	90 mgm. glucose per 100 c.c. blood
1 hour after glucose given	137 mgm. glucose per 100 c.c. blood
1½ hours after glucose given	106 mgm. glucose per 100 c.c. blood
2 hours after glucose given	90 mgm. glucose per 100 c.c. blood

Urine passed two hours after ingestion of glucose contained 5 per cent glucose.

As the patient was therefore not a true case of diabetes she was encouraged to take a full diet. Five days later a blood sugar estimation was twice again performed:—

2 hours after full breakfast	100 mgm. glucose per 100 c.c. blood
1 hour after full dinner	135 mgm. glucose per 100 c.c. blood

The subsequent history may be briefly stated. Fourteen urine examinations were carried out during the last three months of pregnancy, including early-morning and 24-hour specimens. Sugar was always present (3·7 per cent during the eighth month and 3·8 per cent during the ninth month, on full diet). Yeast tests, with controls, were several times performed and were always definitely positive. Ketone bodies were frequently tested for (Rothera) and never present. Instrumental delivery was effected at full term under chloroform and ether, without complications. The mild pruritus, etc., rapidly disappeared after confinement.

Urine twenty-two days after confinement contained 2·5 per cent sugar, and thirty-six days after confinement 1·8 per cent sugar. Unfortunately, change of station prevented further examinations, but it was reported to me about two months later that Mrs. Fr. was quite well.

Case 2.—Mrs. W., aged 23. Primigravida 7 months.

Previous health good. Patient looks and feels well, but also complains of slight pruritus vulvæ of recent origin. Glucose, confirmed by yeast test, found in routine examination of urine early during seventh month. History of case:—

Urinary examinations during fourth, fifth and sixth months revealed no sugar. After its discovery a sugar tolerance test with 50 grammes of glucose was performed during the seventh month with the result:—

Fasting blood	63 mgm. glucose per 100 c.c. blood
40 minutes after glucose given ..	136 mgm. glucose per 100 c.c. blood
75 minutes after glucose given ..	128 mgm. glucose per 100 c.c. blood
120 minutes after glucose given ..	110 mgm. glucose per 100 c.c. blood

Urine passed one hour forty minutes after ingestion of glucose contained 0·2 per cent sugar and fermented yeast.

The patient's diet was not restricted at any time except for the performance of the tolerance test. The urine was again examined for sugar as follows:—

Middle of 7th month :	before breakfast 0·1 per cent,	after breakfast 0·4 per cent *
End of 7th month :	before breakfast 0·1 per cent,	after breakfast 0·3 per cent
Middle of 8th month :	before breakfast 0·2 per cent,	after breakfast 0·5 per cent
Middle of 9th month :		, after breakfast nil
One week after parturition		, after breakfast nil
Two months after parturition		, after breakfast nil

* Four hours after breakfast, sugar was absent.

The urine was examined seven times for ketone bodies (before and after breakfast specimens) but was always negative. No albumin or casts were found and there was nothing to indicate renal disease. S.G. varied from 1006 to 1022. The specimen containing 0·4 per cent sugar was fermented by yeast for twenty-four hours, filtered, and the filtrate failed to reduce Benedict's solution, so that no lactose was present with the glucose. Parturition was uneventful.

Case 3.—Mrs. C. Multigravida (2).

No relevant previous history. Looks healthy, but states definitely she is eating and drinking more than before her pregnancy, and complains of some thirst and frequency of micturition, especially at night. There is a mild complicating cystitis dating from before the pregnancy.

The urine examined monthly from the fourth to the eighth month inclusive was negative for sugar. Early in the ninth month a small amount of glucose, confirmed by yeast, was discovered. A partial sugar tolerance test (50 grammes glucose) was then carried out with the following results:—

50 minutes after glucose given	140 mgm. glucose per 100 c.c. blood
1½ hours after glucose given	134 mgm. glucose per 100 c.c. blood
2 hours after glucose given	100 mgm. glucose per 100 c.c. blood

Urine passed seventy-five minutes after ingestion of glucose contained no sugar.

The patient was allowed full diet. Thirteen further examinations of urine were carried out: one before parturition (negative) and the remainder from the day of parturition until fifteen days later. Sugar was only found on the following days after parturition:—

2nd day after parturition	0·5 per cent sugar present in urine
4th day after parturition	(*a*) first specimen 0·3 per cent sugar (yeast fermentation +, no lactose present)
	(*b*) second specimen 0·1 per cent sugar

Thereafter the urine contained no sugar. Pus cells were found in moderate numbers, usually a trace of albumin was present and one culture was sterile. Ketone bodies (four examinations) were not found. The patient's general health continued satisfactory.

Case 4.—Mrs. S., aged 23.

Only a few urine examinations were made during the pregnancy as the patient looked and felt well. One sample of urine contained 0·5 per cent. sugar and fermented yeast (positive and negative controls), but after twenty-four hours fermentation with yeast still reduced Benedict's solution to less extent. Chemicals were not available to make lactosozone test but presumably lactose was also present. Later urine examinations were negative for sugar. No acetone or albumin present. Patient continued healthy without treatment.

Case 5.—Mrs. Fo.

A search of the laboratory records produced notes of another case, possibly of this type, but neither the dates of origin nor cessation of glycosuria were recorded. Thirty-four examinations of urine were made from three weeks before until one month after parturition, and in all sugar was present, ranging from 0·19 to 1·3 per cent. Lactose was stated to have been excluded. Ketone bodies were present from three weeks before until two days after parturition, and were thereafter absent. No albumin. Specific gravity 1013 to 1027.

Blood-sugar examinations :—

19 days before parturition :	114 mgm. glucose per 100 c.c. blood
17 days before parturition :	104 mgm. glucose per 100 c.c. blood
Date unspecified :	80 mgm. glucose per 100 c.c. blood
5 days after parturition :	50 mgm. glucose per 100 c.c. blood
9 days after parturition :	125 mgm. glucose per 100 c.c. blood *
1 month after parturition :	156 mgm. glucose per 100 c.c. blood
6 weeks after parturition :	glucose tolerance test—"blood sugar returned to normal in 2 hours"

* "After 50 grammes glucose given."

While the above investigations were being carried out it was decided that Mrs. Fo. was not a true case of diabetes and therefore diet restrictions were removed, without ill effect. Insulin was given on several occasions but was discarded as it had no good effect, and it did not abolish the ketosis. The general health continued satisfactory without treatment.

Conclusions.

(1) Five cases of glycosuria occurring during pregnancy have been briefly described. None of these were cases of true diabetes, and in the four in which blood-sugar estimations were carried out no hyperglycæmia was found.

(2) In Cases 1 and 2 the onset of glycosuria was in the seventh month, in Case 3 in the ninth month. Cases 2 and 4 cleared up before parturition, Case 3 a few days after it, and Case 1 probably within two months or so of parturition.

(3) The concentration of sugar in the urine varied on a normal diet from 0·1 per cent to 3·8 per cent.

(4) The general health of the patients was good and continued so without treatment. Cases 1 and 2 complained of mild local symptoms presumably due to the glycosuria. Case 4 had no symptoms whatever.

(5) No ketosis was found except in Case 5. It cannot be stated definitely however that this last case was due simply to the pregnancy.

My thanks are due to Lieutenant-Colonel O. R. McEwen, M.D., M.R.C.P., R.A.M.C., Officer Commanding the Military Hospital, Colchester, for permission to send this article for publication.

MUSINGS ON URINARY pH VALUES.

By Major I. H. LLOYD-WILLIAMS, M.C., M.B.,
Royal Army Medical Corps (T.A.).

THE kidney has as its function the voidance of waste products, both solid and liquid. The urine thus secreted is an index of the metabolism of the body with or without changes superadded as a result of disease of the urinary tract.

It must be realized that the body is continually striving to keep the composition of its circulating fluids at a constant level. The optimum range of blood reaction is slightly alkaline, being 7·28 to 7·41. Apart from diseased conditions, biochemical variations occur in different parts of the circulation as a result of such physiological functions as digestion and exercise. Urinary analysis is one of the methods of assessing these changes in vital functions.

The kidney is a compact and very complex system of glomeruli and tubules. The part played by the various sections in the secretion of the finished urinary product must remain to a large extent a matter of speculation. Its anatomical structure and position do not lend themselves to direct experiment.

Its functions are: (1) The excretion of fluids; (2) the concentration and excretion of solids and in some cases bacteria. For any one substance in the blood there is a renal threshold; concentration above this level leads to its excretion in the urine. This threshold may vary from the normal as a result of renal or cardiovascular disease. In this article the normal kidney only is being considered.

Urinary reaction is normally tested with litmus paper. This method unfortunately gives no numerical index of acidity or alkalinity for comparison or estimation of the total acid passed per diem, the normal being estimated as equal to between 20 and 40 cubic centimetres of N/10 NaOH per 100 cubic centimetres of urine passed in twenty-four hours.

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The testing of the reaction is best done by some colorimetric method such as the B.D.H. capillator. This reaction is dependent on the electrical dissociation of salts and the figure depends on the relative proportion of H and OH ions. Ionization will vary with the electrolyte and its concentration. An appropriate mixture of urine and test dye is compared with a set of standard colours marked with the pH values. The figure 7 is taken as neutrality; figures towards zero indicate acidity; whilst those towards 14 demonstrate alkalinity. It has been stated that the normal urinary range is pH 5-7, McDowall gives 5·5 to 7; from the figures collected I should place 5·5 to 8 as being the symptomless zone. A certain degree of alkalinity would also be in accordance with the normal teaching that the alkaline tide is commoner in the forenoon, and about three hours after meals.

The reaction is usually dependent on the presence of one or other of the phosphates of sodium. On standing ammoniacal decomposition takes place as also in certain cystic conditions. The presence of ammonia will thus alter the reaction, and it is desirable that all specimens should be fresh for testing.

The figures given by me are from my own observations. Certain conclusions are drawn tentatively, but finality is not claimed as there has not been sufficient material. More observations are necessary to elucidate some of the metabolic problems. In some cases chemical analysis would be interesting: for instance as to whether lactic acid appears in the urine after exercise.

Physiological variations are apt to occur. The urine of man and the carnivora is stated to be more acid than that of herbivora. This is based on an increased acid elimination as a result of protein digestion as opposed to a surplus of basic substances in vegetable food. This variation should show itself by the urine being more acid in winter when a relative excess of meat is eaten as opposed to the more vegetarian diet in summer.

Acidity is increased by exercise as a result of which lactic acid appears in the blood (McDowell) [1]. This substance not being a normal constituent of blood must either be oxidized as in the liver, or be excreted by the kidney or sweat. Evidence of either of these methods of excretion should be forthcoming as a result of chemical analysis of the urine or sweat. It may be noted that lactic acid does not ionize freely, whereas its salts would do so more easily; this has its bearing on pH values in the blood or urine.

From my records there does not appear to be any relationship between the reaction and specific gravity, except that where there is a lateritious deposit an increase in the acidity and specific gravity have been noted. In one such case the readings were pH 4·7 and specific gravity 1030. On the other hand pH of 5·1 and 8·2 have been noted with specific gravity of

1010 and 1015 respectively. In febrile conditions a figure of 4·2 can easily be reached.

It has been stated by some that the present habit of giving oranges freely has a deleterious effect on the acid-base balance, and calcium metabolism in such processes as the healing of fractures. So far as my observations are concerned this is not borne out. I have not noticed any increase in urinary pH value and X-ray photos have shown satisfactory deposition of calcium in bones.

Frequency of micturition and scalding are noticed with a pH of 5 or upwards, the highest figures occurring in elderly patients being 3·3 and 3·8. A pH of 5 may be asymptomatic. The irritation in some cases may be due more to the presence of crystals than to acid.

In children nocturnal frequency and scalding have been met with a pH of 8·7, no deposit being present.

Two children in the post-influenzal state passed, just before food, specimens which had a lateritious deposit and pH 5.

As examples of the alkaline tide in the normal state the following may be taken: child, aged 5, pH 7·2, slight deposit of phosphates on boiling; adult night specimen pH 8·2.

In rheumatism there tends to be an increased excretion of acid during the attacks. This does not seem to have any relation to diet; from the dietary aspect in some cases a more alkaline urine might be expected. Readings of pH 5 are common in rheumatic attacks and I have met 4·7 or more in acute lumbago. With the high acidity of the latter there is almost always a lateritious deposit.

This acidity raises the question of metabolic disturbance in rheumatism and rheumatic gout. Diet in certain cases has a definite effect. For instance one patient complained of the pain being worse after taking stewed rhubarb, the liquor of which had a pH of 1.

Under certain conditions, such as acute rheumatism, the sweat is unduly acid, an index of increased acid formation.

In lumbago there is fibrositis of the affected muscle. This would interfere with the circulation and metabolities be retained longer than normal. This retention itself would tend to produce fibrosis from irritation. It has been shown recently that the injection of lactic acid into muscle produces pain, and it may legitimately be inferred that some of the pain in fibrositis and in stiffness after exercise is due to a local retention of lactic acid.

In a case of diabetes without acidosis, pH readings in twenty-four hour specimens were 5·7, 6·7, 6·0, 5·6, 6·2, 6·3.

In a child aged 10, where there was a tentative diagnosis of cyclical vomiting, the urinary pH was 7·8, a reading which was taken to negative the diagnosis. A week later when the symptoms had disappeared the acidity had risen to 5·1.

During the febrile period in a child the acidity was 5.

A child, aged 5, in bed on a milk diet and suffering from intestinal tuberculosis, had a pH of 8·2 and phosphatic deposit.

Excessive acidity is stated to occur in some cases of eczema.

The therapeutic rendering of the urine acid is now largely used in the treatment of *B. coli* in urine. In the older treatment with hexamine this was attained by the exhibition of sodium acid phosphate. The amount given was governed more by rule of thumb than the exact estimation of urinary acidity.

The more modern treatment by mandelic acid requires control of the acid at a level of 5 or more.

It has been shown (Stohl and Janney, 1917) [2] that *B. coli* will not grow when the pH is between 4·7 and 5.

Nitro-hydrochloric acid has also been used for rendering the urine acid (Chance and Maloney, 1935) [3]. It is in this regard interesting to note that the use of 1 per cent lactic acid (which has a pH 1 approx.) is of considerable value as an irrigating fluid in cases of appendix abscess (Lloyd-Williams, 1915) [4]. The inhibition is probably due to the high pH value. A similar action has been observed in chronic enteritis as a result of the administration of lactic acid bacilli and of the acid itself (Lloyd-Williams, 1923) [5].

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[3] Chance and Maloney. "A New Acid Medication in the Treatment of Bacilluria," *Ibid*, **33**, 657, 1935.

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Travel.

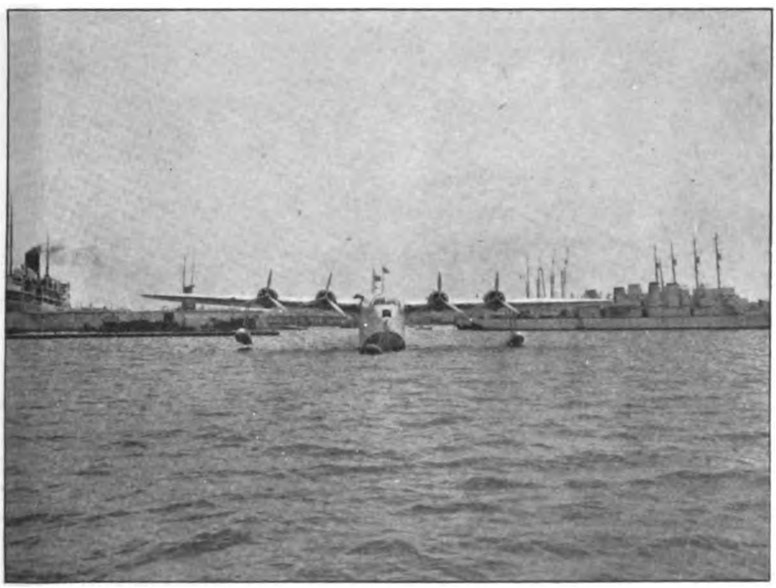
FROM ROME TO KARACHI BY AIR.

By Colonel K. COMYN.

(*Continued from page* 61).

A perfect landing was made in the crowded harbour of Alexandria and the 587 miles from Athens completed. The stay at Alexandria lasted rather more than one hour. The passengers were taken to the sailing club for this period while the flying boat was refuelled, engines looked over and crew changed. At 12.30 we took the air again and after circling over the harbour turned east for Aboukir Bay and thence to Palestine, across the Eastern Mediterranean. The sea is left at Haifa and we strike inland past Mount Carmel. There is nothing very striking or unusual in the appearance of the country here from the air and an uneventful lap is

completed on landing at Tiberias on the sea of Galilee, 352 miles from Alexandria. The landing place at Tiberias is very picturesque, with a good landing quay, a hotel and restaurant and several good villas on the side of the lake. After refuelling here we took off again at about 14.30 hours for Lake Habbaniyeh in Irak, a hop of 469 miles first across a part of the French mandated territory of Syria, past the country now occupied by the Jebel Druses and then across some 300 miles of Syrian desert. The Syrian desert looks very forbidding, hundreds of miles of barren waste, sand, mud, bituminous and limestone rock alternating. Here and there are low ranges



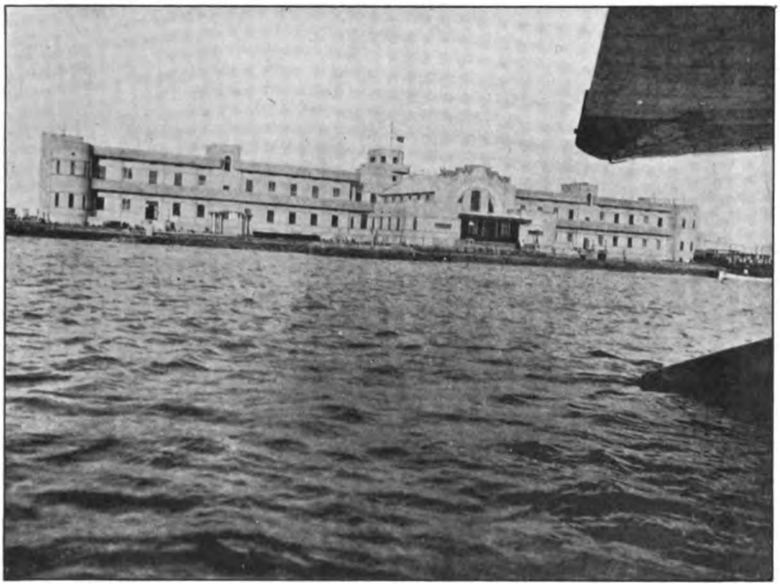
"Ceres" in Alexandria Harbour.

of rocky hills and deep rocky gorges. The whole area is very sparsely populated by small groups of nomad Arabs, existing as best they can in small collections of crude mud huts, surrounded by a very limited patch of irrigated land barely sufficient to provide crops enough for a few sheep and goats and their owners. The colours of this waste land varied from the yellow of the sand to orange, dark brown and black. As I looked down on this rocky, sandy, muddy brown waste I wondered what would happen if we developed engine trouble anywhere on this 460 mile stretch, with our minimum landing speed about eighty-five miles per hour, our 18 tons weight and our light landing sea floats to take the shock, but I was glad to know that these flying boats are said to be capable of carrying on with only two of four engines functioning.

Rather more than half way from Tiberias to Lake Habbaniyeh the

pipe line of the Iraq Petroleum Oil Company is crossed on its way to Haifa—then also in places the desert track of the Nairn Trading Company route to Damascus is seen. We saw four lorries traversing this lonely route proceeding in couples, going along at considerable speed and leaving behind a cloud of dust.

It seems amazing that there should be such vast tracts on the earth uninhabited and seemingly uninhabitable. We reached Lake Habbaniyeh at dusk. Here is now a big station of considerable extent, both R.A.F. and Imperial Airways, but there is nothing else.

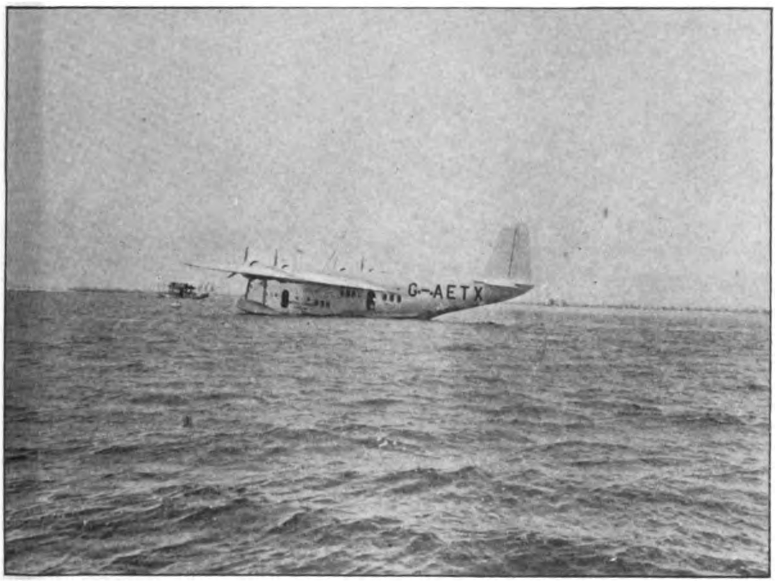


The Modern Airport Buildings, Basrah.

Flying over the Syrian desert we had to rise to 10,000 feet to avoid "bumpiness." Desert areas are always more bumpy than most other localities owing to hot air currents rising, formed by radiation of the sun's rays from the bare rock and sand, and cold air currents descending to take their place.

Refuelling at Lake Habbaniyeh occupied a matter of twenty minutes but the stay was prolonged by what appeared to be unnecessary delay over passport formalities. At last, however, we got off as night was falling. Shortly after taking off from Lake Habbaniyeh, while it was still twilight it was possible to see the Euphrates and Tigris rivers stretching away into the distant haze like two winding ribbons of silver laid out on the rapidly darkening sand. It is from these two rivers that the old name of Mesopotamia now merged in Iraq was derived. Further south they join

together to form the Shatt-al-arab, meaning " River of the Arabs " running down to join the Persian Gulf below Basrah. The flight from Lake Habbaniyeh to Basrah was, much to my regret, flown almost entirely in the dark. Although the whole of this distance, 316 miles, is little else but sandy desert, yet historically it is one of the most interesting areas in the middle east, covering the sites of the ancient empires of Babylon, Nineveh and Ur of the Chaldees; once a rich and fertile land until the wrecking of the irrigation system in the thirteenth century reduced it to parched desert. Perhaps some centuries hence a new system of irrigation may bring back its fertility and prosperity once more.



" Ceres " in the Persian Gulf.

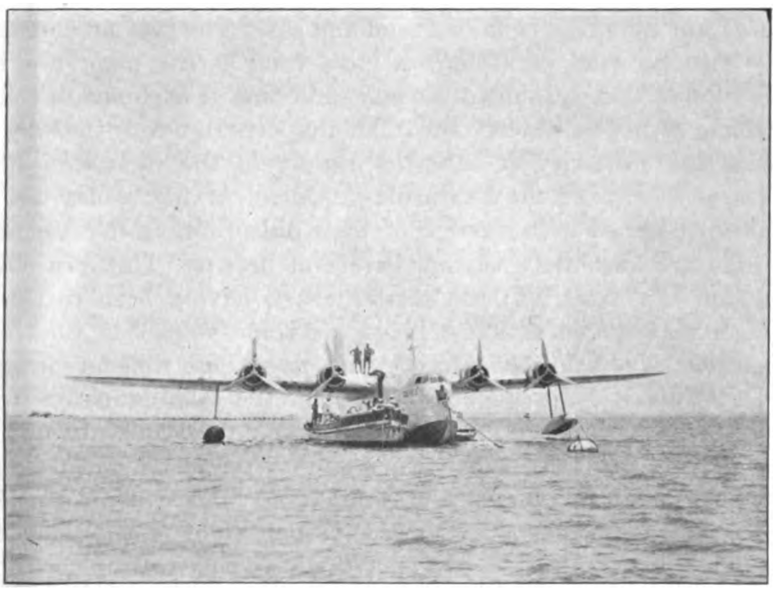
We reached Basrah at about 20.00 hours, landing on the waters of the Shatt-al-Arab in a creek in front of the modern hotel and Irak Port Directorate buildings. Basrah airport is considered one of the finest in the world. On one side of the Directorate building is the landing site for Imperial Airways flying boats and R.A.F. seaplanes, on the other side is a very fine landing ground for land planes, splendidly prepared, levelled and tarmaced. The hotel itself is most up-to-date and first-rate. It was only opened in 1938 and is run by the Irak Port Directorate. Every room has its own bathroom and lavatory of the most modern type, electric fans for the hot weather, radiators for cold, even electric clocks in all bedrooms. Downstairs is a modern bar, good billiard room, lounge, dining room, etc. The service, too, is excellent. Our stay here was all too short as we were

to leave again in the morning at sunrise; called at 04.30 hours, tea and bath, embark at 05.15, and take off at 05.30. Shortly after leaving Basrah we reached the head of the Persian Gulf. Looking down, the sea appears greenish blue; it is very shallow, studded with sand and mud banks, some white with salt, others yellowish brown from silted mud. There is no clear-cut coast line here, but undetermined sandbanks and bays, and away to the west, the flat, sandy Arabian desert stretches, melting into the haze where sea and sand and sky seem to meet, hundreds of miles of emptiness. Below us, too, can be seen again that shadow like the little hornet following us, our shadow reflected on the sea, and on sand and mud.

"Ceres." Sunrise on the Shatt-al-Arab.

As the sun rises the temperature becomes hotter. We are dressed in shorts and open shirts and rugs have been stowed away, the tube ventilating shafts bringing cool air to each passenger's seat. But in spite of the cooling draught of air my pat of butter at breakfast was soon reduced to a liquid amber pool not unlike the pools 1,000 feet below us. The route from Basrah to Bahrein, 344 miles, was all the same; proceeding down the Arabian coast on the west side of the Persian Gulf, we reached Bahrein at about 08.30 hours. This is a surprising place. Far away on the Persian Gulf one expected to find an isolated primitive place with a small community, but on the contrary Bahrein, or rather Manama, the European part, is an up-to-date flourishing township. It has sprung up owing to the discovery of oil in the near vicinity, and an American company has

sunk wells, built refineries and established a considerable oil industry. There are splendid bungalows, air-conditioned cinemas, motor cars, private sailing and motor boats, and other sights of advanced civilization. As we circled over this township coming in to land I noticed one of many bungalows with a splendid garden, concrete tennis court and large swimming pool all in its own compound and also its own landing stage on the edge of the sea for sailing or motor boat. Then on the other side of the small bay is a more ancient Arab town. This has been the centre of the pearling industry in the Gulf for generations. The local Sheik has made a fortune for years out of the pearl industry. I am told he is now increasing it



"Ceres." Refuelling at Dabai, Persian Gulf.

enormously by his rake-off from oil concessions. On landing on the quay here, one was offered small seed pearls by local Arabs. They are, of course, mostly worthless, but I was told that if one knew where to go amongst the local Arabs it was possible to obtain quite good pearls very cheaply, but a good knowledge of pearls is necessary before one attempts to strike a bargain.

Bahrein seemed cooler just then than most parts of India at this time of year—there was a cool breeze coming in from the sea. September is the worst month. The sea was shallow and seemed to abound with fish of all sizes.

After the usual half hour or so for refuelling and stretching of legs on the quay for passengers, we took off for the next lap of 300 miles to Dabai on the Oman Peninsula. Between Bahrein and Dabai we cross open sea

again and there is nothing much to note. We fly at about 1,000 feet and the flying boat is very steady, there is little or no vibration or movement, writing is quite easy and it is quite comfortable to carry on a conversation if one wishes to with other passengers. From Tiberia to Bahrein there were only three passengers — the Imperial Airways' officer going to Bangkok, the French business man and myself. At Bahrein we took on another passenger for Karachi, an Indian Medical Service officer whom I had met before in India, who had been to Bahrein to carry out a mosquito and anti-malaria survey on behalf of the Government.

The landing at Dabai on the Oman Peninsula is in a narrow creek. There are a few Arab huts, a small landing-stage and store huts for petrol. All around, for hundreds of miles, sand and sea. The take-off does not look too easy with no wind or perhaps a cross-wind as the plane has to taxi towards shallow water, mud shoals and sand flats at each end of the creek before rising from the water. Such landing sites in out-of-the-way places emphasize the necessity of adhering rigidly to the limitation of load. From Dabai we crossed the Peninsula of Oman, Arabia, as desolate a spot as could be imagined with a range of high hills running the length of it. These hills are absolutely barren, bare and brown. They are obviously formed from a "fault" in the earth's crust, having been thrust up by volcanic or earthquake action. There are some valleys in this range of hills in which, it is said, the temperature is so high that no form of life can exist. This is quite understandable for the solar radiation from the precipitous slopes of limestone or gneiss volcanic rocks must be terrific.

Flying over this peninsula with its rocky pinnacles and deep gorges the air pockets and currents were numerous and caused considerable bumpiness, but it was not much more than half an hour before we reached open sea again and directed our course across the Gulf of Oman to the Persian or Iran Coast, striking the coast near the Iran-Baluchistan border. Here we landed at Jiuni, a creek on the Baluchistan coast which has taken the place of Gwadar Bay as a landing-place. It is approximately 450 miles from Dabai. Having refuelled here, we took off again on the last lap of the journey to Karachi. Now we passed some of the most interesting rocky coast scenery, which must be unique, and obviously due to geological faults of earthquake or volcanic origin. The sandstone strata, or perhaps they are volcanic lava, have been thrown up to a height of 1,000 to 1,300 feet with a layer of brownish rock on the top. The sandstone is in column formation looking like masses of tubes resembling those of a large church organ, set side by side. Many of these are of enormous diameter and are hollowed, no doubt originally by gases emanating from the earth's core. In one place this similarity to church organ pipes or to fine Gothic pinnacled architecture is so striking as to have given rise to the name "the Cathedral rock."

The remainder of the trip is very ordinary, flying very steadily along the Baluchistan coast at about 500 feet up, occasionally dipping into low thin cloud, and then quite suddenly, here we are at Kiamari, the port of Karachi, at 18·15 hours, and our journey by air ended.

The total distance flown from Bracciano, Rome, to Karachi was 3,791 miles, leaving Rome air base at 16.15 hours on Sunday and arriving at Karachi air base 18.15 on Tuesday. The first half day's flying covered 683 miles to Athens, on the Monday we did 1,724 miles Athens to Basrah, and the last day, Tuesday, 1,384 from Basrah to Karachi. The average speed was 160 to 165 miles per hour. We landed ten times between Rome and Karachi, refuelling at each stop, taking up or putting off passengers or mail at some places. At each of these stopping places, when refuelling, one is asked politely if one would like a breath of fresh air in the launch or to stretch one's legs on the quay for a quarter of an hour; one is always ready to do so, to have a look at the flying boat lying at her mooring and for a look round. I soon discovered, however, that what I considered great thoughtfulness and consideration on the part of the ship's officers was really a polite way of getting us out of the way during refuelling. All the passengers and most of the crew, all except two, I think, usually are taken off in the launch in this way owing to the danger of fire from petrol fumes—may be from the careless smoker, perhaps, or some other cause.

It must not be supposed, when looking down the list of places called at on this route that such a trip affords a good opportunity for sight seeing. It does not. It enables one to study country and geographical features between towns and cities, but there is no opportunity of seeing the places themselves. Landings are mostly at some distance from the towns and stops rarely exceed one hour, more usually are half an hour, just enough for refuelling, a quick survey of engines, examination of passports and interchange of passengers. At places where the night is spent one usually arrives late in the evening and leaves again at crack o' dawn, 05.30 or 06.00 hours. But as the whole essence of air transport is speed of transit and that this and safety cannot be combined with sight-seeing facilities, this criticism is unfair.

As regards expenses *en route*. They are nil, apart from any drinks one has on board or at hotels at which one stops.

All bus arrangements, hotel bills, tips and feeding arrangements are included in the fare, anything beyond this is not asked for and does not seem to be expected. The Company make it a point of their service that the passage rate covers every expense.

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Several of the passengers were air sick at times, but this did not seem to last long, recovery seems to be more rapid than in the case of sea sickness. Fortunately, I did not suffer at all this way myself,

although the steward at one time while crossing the hilly desolate peninsula of Oman did his best to make me so by producing a large and convenient bowl and placing it by my side, but it had no other effect than producing a smile of complacency on my face. I enjoyed every moment of the trip. I cannot speak too highly of the comfort and almost unbelievable celerity of this means of proceeding to or from India.

Current Literature.

WELLS, W. F., & WELLS, MILDRED W. **Measurement of Sanitary Ventilation.** *Amer. J. Pub. Health.* 1938, v. 28, 343-50, 2 figs. [10 refs.]

[The abstractor considers this to be a most important paper and one that may well mark the beginning of a new approach to the problem of preventing air-borne infections.] The authors, in their introduction, state that a control of the sanitary condition of the air of buildings, lessening the risk of air-borne infections, is now, as a result of experience of the last few years, as much within our reach as is the prevention of intestinal infection due to impure water or impure food.

The Nature of Air-Borne Infection.

It has been shown :—

" (1) During coughing and sneezing, minute droplets containing micro-organisms from infected surfaces may be ejected into the air.

(2) Most of these droplets are sufficiently small to evaporate before they can settle to the ground, leaving minute residues suspended in the air.

(3) These nuclei, in which the micro-organisms remain viable for considerable periods, may drift in air currents as would particles of cigarette smoke.

(4) The air breathed commonly by the various persons congregated in a room or other enclosed space can thereby transfer these organisms from one person to another and plant them upon the susceptible tissues of the respiratory tract."

[Measurements of air-borne organisms have often been made in the past by exposing culture plates in the air to be tested, but the adhesion of bacteria (in size so small as to have a theoretical rate of settling in still air of less than 1 millimetre per second) must be very much a matter of chance dependent upon accidental draughts, and also perhaps upon electrical charges of which we know little.]

The authors base their findings on measurements of air-borne cultures of *Bact. coli*, which may be blown up into the air in spray droplets from

a special atomizer at a known rate. The resulting concentration of air-borne bacteria can be accurately measured by means of the Wells centrifuge. (With this apparatus a considerable volume of the air to be sampled is drawn through a rapidly rotating tube, the suspended solids being driven on to an agar film covering the sides of the tube by centrifugal force.)

Eosin-methylene blue agar is used in these tubes as a culture medium for this particular work, having the advantage that it is favourable to the growth of *Bact. coli*, but inhibits that of other organisms.

Armed with these two pieces of apparatus—termed by the authors the "infector" and the "infectee"—it becomes possible to investigate the potential danger to persons in any part of a room caused by a sufferer from a complaint giving off air-borne bacteria in any other part of the room. Thus, when testing the protection of an operating table from air-borne bacteria, the infectee (or centrifuge) is placed in the middle of the theatre at the level of the operating table and the infector (or atomizer) is placed successively in each corner of the room.

The authors introduce a new term—equivalent ventilation—so that the effects of devices that destroy floating bacteria in situ may be expressed in terms of air change, or the removal from the confined space of a given proportion of the volume of air in a chosen unit of time and replacement by clean air.

Two methods of measuring this rate of equivalent ventilation by taking samples of air-borne *Bact. coli* are described—the method of the Die-away and the method of Equilibrium. The methods are based on the logarithmic properties of concentration curves and are somewhat similar to those used to determine the rate of air change in rooms by measuring the changing concentrations of coal gas or hydrogen.

Methods of Bacterial Ventilation.

Irradiation of Recirculated Air.—Air may be recirculated through ducts fitted with sources of ultra-violet light—as air filters and washers are used—and this recirculated fraction returned to the room duly sterilized. But the authors show that this method is comparatively ineffective—except perhaps in railroad cars.

Direct Irradiation of a Room.—This can be very effective in operating theatres (where the eyes can be protected from the radiations).

Partial Irradiation.—The authors contend that the best method for large buildings is to irradiate the space above the level of the eyes of the occupants. Disinfection of the air in the unirradiated zone then depends upon air movement through the irradiated space, as well as upon the spatial distribution of the radiation. [This suggests to the abstractor the provision of low velocity air circulation by mechanical means.]

Light Barriers.—The air of cubicles may be kept free of contamination from the general air of a hospital ward, or *vice versa*, by beams of ultra-violet radiation covering all air-ways. This arrangement may be tested by the infector and infectee.

Studies on these problems are now in progress in the U.S.A. The original paper should be consulted. T. C. ANGUS.

Reprinted from "Bulletin of Hygiene," Vol. 13, *No.* 12.

RAMON, G. La sèro-anatoxithérapie antidiphthérique, son but, ses bases. Premiers résultats d'ensemble. [**The Treatment of Diphtheria by the Combined Use of Antitoxin and Toxoid.**] *Bull. et Mém. Soc. Méd. Hôpit. de Paris.* 1938, July 18, 1301-8. [15 refs.]

In this paper the author discusses the value of combined passive with active immunization (i.e. with antitoxin and toxoid) in the treatment of diphtheria, particularly with reference to the prevention of late complications and relapses. Ramon and Zoëller (*Ann. Inst. Pasteur*, 1927, v. 41, 803) applied the combined method to the treatment of human tetanus. The method recommended for diphtheria is as follows: 0·1 cubic centimetre of formol-toxoid is first injected, then after twenty to sixty minutes a massive dose of antitoxin is injected at a different subcutaneous site. After forty-eight hours, provided there has been no severe general or local reaction, a second dose of formol-toxoid (0·5-1 cubic centimetre) is given. Thereafter at five-day intervals increasing doses of toxoid (1, 2, 3 cubic centimetres, etc.) are given—in all, four doses. Up to the present time more than 120 cases of diphtheria have been treated according to this scheme. Undesirable reaction followed the injections in some instances, but were never such as to cause serious concern. The general results of the treatment were excellent. Only three slight and transient palatine paralyses were met with in the 120 cases. As a rule the final state of active immunity reached as gauged by the antitoxin content of the blood was as great as that obtained by the usual methods of active immunization. The special advantage of the method is that it protects against relapses and is followed by a lasting and effective immunity. C. C. OKELL.

Reprinted from "Bulletin of Hygiene," Vol. 13, *No.* 12.

DEBRÉ, R., & MALLET. Séro-anatoxithérapie de la diphtérie (premiers essais personnels). [**The Treatment of Diphtheria by the Combined Use of Antitoxin and Toxoid.**] *Bull. et Mém. Soc. Méd. Hôpit. de Paris.* 1938, July 18, 1308-9.

The authors describe their experiences with the method of M. Ramon described above. A single massive dose of antitoxin of 20,000-60,000 units was given and at the same time, but at a different site of injection,

0·1 cubic centimetre of purified toxoid (150 Lf. per cubic centimetre). Two days later a second dose of toxoid (0·5 cubic centimetre) was given. The toxoid injections were separated at five-day intervals, 1, 2, 3 and 4 cubic centimetres being given in succession. The authors have followed through 15 cases of mild diphtheria treated in this way. The local and general reactions were minimal. All the patients did well. At the end of one month or six weeks the blood antitoxin reached a stable level of ⅓-1 unit per cubic centimetre which could be taken as evidence that active immunity had been established. It may be stated that toxoid given during the course of diphtheria favours the establishment of active immunity and that the development of this active immunity is not interfered with by the passive immunity conferred by serotherapy.

C. C. OKELL.

Reprinted from " Bulletin of Hygiene," Vol. 13, *No.* 12.

Reviews.

PRACTICAL PATHOLOGY INCLUDING MORBID ANATOMY AND POST-MORTEM TECHNIQUE. By James Miller, M.D., D.Sc., F.R.C.P.E., F.R.C.P.Can., F.R.S.C., and James Davidson, M.B., Ch.B.Ed., F.R.C.P.E. Third Edition. 1938. Pp. xvi+517. London: Adam and Charles Black. Price 25s. net.

The fact that a third edition of this book has now made its appearance is evidence of the popularity of the work. Much new material has been added to the various chapters and consequently the present edition is considerably larger than its predecessors.

The chief merit of the book is that it presents the essentials of a very large subject concisely and clearly.

The introductory chapter gives sound advice to those of us who may be called upon to perform an autopsy, and in the chapters that follow a detailed description is given of the method of procedure which should be carried out at post-mortem examinations. A chapter worthy of special note is that concerned with the examination of material removed at operations; the subject is discussed from the point of view both of the surgeon and the pathologist. Detailed examination of the various structures of the body is dealt with in subsequent chapters. In addition, there is a useful section on diseases of pregnancy.

The essential features of the various tumours are presented in a concise manner in a chapter devoted entirely to neoplasms.

The points to be remembered in performing autopsies on cases with a

medico-legal aspect are also dealt with in this volume, and examples are given of typical post-mortem reports in the form in which they should be rendered. Finally there is an appendix which contains much useful information.

The book is not intended to supplant larger text books but to present the subject to the student and practitioner in the form of a handy volume which can be used in the practical class-room and museum: as such it is an extremely useful book and can be strongly recommended.

CHEMICAL ANALYSIS FOR MEDICAL STUDENTS: QUALITATIVE AND VOLUMETRIC. By R. E. Illingworth, Ph.D., B.Sc. 1938. Pp. xii+152. Edinburgh: E. and S. Livingstone. Price 5s.

As the title indicates, this practical chemistry book was written primarily for medical students, but its use could be extended to candidates for some of the Diploma of Public Health examinations. It is not sufficiently comprehensive for the ordinary science student nor for use in chemical laboratories.

The book can be divided into three parts. The first comprises the identification of single substances of an inorganic nature by the use of simplified tables. The second part gives tests for organic compounds used in medicine and the third gives details of volumetric estimations.

The book is interleaved with blank pages for notes, is well printed and free from typographical errors.

In a future edition it might perhaps be useful to indicate in an Appendix how certain solutions, such as Fehling's, or reagents such as phenyl-hydrazine mixture (page 57), should be made.

The book is thoroughly recommended to those for whom it was written.

THE BRITISH MOSQUITOES. By J. F. Marshall, C.B.E., M.A., F.R.E.S. Director, British Mosquito Control Institute, Hayling Island, Hants. 1938. Pp. xii+341. London: Printed by order of the Trustees of the British Museum. Price £1.

This volume replaces the Handbook of British mosquitoes by Dr. Lang. It contains the result of the intensive study of our British mosquitoes which has been prosecuted in the intervening years.

A clear description is given of the methods of identification of these insects in all their stages. The first chapter deals with the recognition of a mosquito and is followed by the method of classification. The life history of this diptera is described in all its stages. A large section of the book is devoted to a description of the British mosquitoes and how to recognize them.

The author points out that *Anopheles maculipennis* consists of several "races" only two of which are now found in Britain. This may explain the almost complete disappearance of fresh infection with malaria in this country. In dealing with mosquito control in Britain he rightly emphasizes the importance of a careful study of the habits of the offending mosquitoes before instituting anti-mosquito measures. Such preliminary inquiries frequently lead in the end to economy in both time and money.

The book is well printed and the illustrations are good.

BACTERIOLOGY FOR MEDICAL STUDENTS AND PRACTITIONERS. By A. D. Gardner, D.M., F.R.C.S. Second edition. 1938. Pp. 274, with 26 Tables and 32 Figures in the text. London: Humphrey Milford, Oxford University Press. Price 6s.

In his preface the author states that his object is "to present shortly, readably, and relevantly as much of the vast subject of bacteriology as a medical student or practitioner needs to know: leaving details of technique to a practical course, and emphasizing the wider biological relations of microbe and man."

Within the restricted compass of 274 small pages, the success which is achieved in this object is remarkable. By judicious selection all redundant material has been avoided, yet there are few subjects which do not receive attention, and everywhere the gist of the matter is presented in a clear and readable fashion. Chapters on protozoa and viruses are included; and in the latter there is a particularly comprehensive yet concise and lucid survey of a subject which the student frequently finds obscure and difficult to understand.

Certain of the tables convey much detailed information in a very compact and useful way: good examples are Table xxii, which summarizes fungus infections, and Table xxvi, which shows the normal flora of the body.

As a general guide to the theoretical rather than the practical aspect of this subject this book can be recommended, not only to students and laboratory assistants, but also to practitioners who wish to possess a brief yet adequate treatise on bacteriology.

Notices.

KING EDWARD VII CONVALESCENT HOME FOR OFFICERS AT OSBORNE.

OSBORNE HOUSE, East Cowes, Isle of Wight, formerly the Island home of Her Majesty the late Queen Victoria, was given to the nation by H.M. King Edward VII as a Convalescent Home for Officers.

The House, which is situated on the Solent in an exceptionally beautiful park of 240 acres, was duly converted into a most delightful and comfortable Convalescent Home for the reception of Convalescent Officers, both serving and retired, and cadets of the Defence Services; and, under certain conditions, both serving and retired Civil Servants.

A staff of fully qualified nursing sisters, masseurs, etc., is employed and special facilities are available for dietary, massage and electrical and light treatment. Medical attendance is free, but in case of special nursing or other special measures or special drugs, a charge is made to cover the cost.

Massage, Diathermy, Ionization, Radiant Heat, Ultra-violet Rays and all electro-therapeutical treatments are provided at a charge normally of 6d. a day.

The organization of the Home, however, is such as to eliminate as far as practicable the atmosphere of Service discipline; it combines all the advantages of a first-class Convalescent Home with those of a County Club for those patients who, in the later stages of convalescence, are able to take full advantage of the recreational facilities provided.

Osborne has its own private golf links within the grounds (about three minutes' walk from the House), and the club, which is second to none in the Island, has its own resident professional. There are also hard and grass tennis courts, a croquet lawn, bowling green, miniature rifle range, and a private bathing beach on the estate. During the winter months the Isle of Wight Foxhounds meet four days a week and the foot beagles on two days. Officers may hunt with the latter pack free of charge, and during the season officers resident at Osborne are Honorary Members of several yacht clubs.

Frequent entertainments, theatricals and dances, are held throughout the year in the Recreation Room, which is provided with a piano, radio-gramophone and cinema. A Silence Room is provided for those who desire quietude and there is an extensive library.

Osborne also has its own motor car which conveys patients free of charge to and from the railway station. The car is available for long and

short runs at a small charge. Garage accommodation is available for patients bringing their own cars.

A private Hostel with limited accommodation for relatives, excluding young children, has been established in a house in the grounds. Any officer desiring to bring his relatives with him should communicate with the House Governor.

The charges payable are very reasonable and are as follows:—

(*a*) Cadets and officers on half pay, 4s. 6d. per day.

(*b*) All other officers, 6s. per day.

For further particulars and booklet apply to the House Governor and Medical Superintendent, Osborne House, East Cowes, Isle of Wight.

Telegraphic Address; "Convalescent Cowes."

Telephone No.: Cowes 251.

CENTENARY OF MEDICAL JOURNAL.

THE *Medical Press and Circular* celebrated its Centenary in January, 1939. It was founded in January, 1839, in Dublin, by Dr. Arthur Jacob, M.D., F.R.C.S.I., under the title of the *Dublin Medical Press* and in 1866 it absorbed the *Medical Circular* and became the *Medical Press and Circular*. From the date of the amalgamation the journal has been published in London. The founder, Dr. Jacob was a very outstanding personality. He practised as an ophthalmic surgeon in which specialty he did much original work. His name is still associated with "Jacob's ulcer" and "Jacob's membrane." For forty-one years he held the Chair of anatomy and surgery at the Royal College of Surgeons of Ireland and was also President of the College. He was closely associated with the founding of Park Street School of Medicine and the City of Dublin Hospital. To these many activities he added in 1839 that of the editorship of the *Medical Press* and through his labours and those of his son Archibald Jacob, M.D., F.R.C.S.I., who succeeded him as editor, much was accomplished in the improvement of the conditions of service of the medical profession in the Public Health Services in Ireland.

A book entitled "The Medical Press and Circular 1839-1939, The History of a Journal" will be published in connection with the Centenary. A dinner was held at Claridge's on January 25.

"EPANUTIN."

MESSRS. PARKE DAVIS AND CO. have sent us the following notes:—

"Epanutin" is a compound which whilst exerting a marked anticonvulsant action in epilepsy has relatively little hypnotic effect. Chemically, "Epanutin" is the sodium salt of 5·5 diphenyl hydantoin, and it is

analogous to the barbiturates, being a derivative of glycolyl urea. It is an odourless, white or cream-coloured powder, soluble in water and has a bitter taste.

In clinical experiments[1] "Epanutin" has been shown to prevent, or greatly decrease, the incidence and severity of convulsive seizures in a substantial percentage of epileptics—without producing the hypnotic and narcotic effects exerted by many anti-convulsant drugs.

The dosage recommended for all cases of epilepsy over six years, is one capsule ($1\frac{1}{2}$ grains) before each of the three regular meals.

THE HEALTH CONGRESS PRESIDENT.

THE Right Hon. the Earl of Harewood, K.G., G.C.V.O., has accepted the office of President of the Health Congress of the Royal Sanitary Institute which is to be held at Scarborough from July 3 to 8, 1939, by The Royal Sanitary Institute.

The Congress will be divided into sections dealing with—

- Preventive Medicine.
- Engineering, Architecture and Town Planning.
- Maternity, Child Welfare and School Hygiene.
- Veterinary Hygiene.
- National Health Insurance.
- Hygiene in Industry.
- Tropical Hygiene.

In addition, there will be conferences of Representatives of Local Authorities, Medical Officers of Health, Engineers and Surveyors, Sanitary Inspectors, and Health Visitors.

LONDON SCHOOL OF HYGIENE AND TROPICAL MEDICINE.

THE Annual Malaria Control Course for Laymen (Engineers, Planters, etc.), will be held at the Ross Institute of Tropical Hygiene, Keppel Street, Gower Street, London, W.C.1, commencing on Monday, June 26, 1939, at 10 a.m.

(1) The Course will be under Sir Malcolm Watson and the staff of the Ross Institute of Tropical Hygiene.

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[1] The clinical evaluation of sodium diphenyl hydantoinate was the subject of a reveiw by Putnam and Merrit of the Harvard Medical School and Boston City Hospital, Neurological Unit, at the annual meeting of the American Medical Association in June, 1938.

(2) The Course lasts five days, and ends on Friday, June 30, 1939. Except on Friday, June 30, the lectures of the Malaria Control Course are given in the mornings only; but (in response to numerous requests from those who have attended in the past) additional afternoon lectures and demonstrations have been arranged on (*a*) Water Supplies, (*b*) Conservancy and Sewage Disposal, (*c*) Insulation against Heat and Cold, Air Conditioning for Comfort in the Tropics. The afternoon lectures and demonstrations will be given by Dr. G. P. Crowden and Mr. H. H. Clay.

(3) The Course is designed for planters and mining engineers, but it will be of interest to all (including missionaries) who are proceeding to the tropics. Doctors may attend, but the Course is primarily for laymen.

(4) It includes instruction on mosquitoes and their habits, drainage and other measures for the prevention of malaria. It is illustrated by lantern slides, films, demonstrations of the living insect in the various stages of its history, and a practical demonstration on Hampstead Heath.

(5) The Course is free. Application to attend the Course should be sent in as early as possible to the Organizing Secretary at the above address.

(6) The most convenient Underground railway stations serving the School are Tottenham Court Road, Goodge Street, Russell Square.

(7) Luncheon can be obtained at the School.

H. Lockwood Stevens,
Organizing Secretary.

EDITORIAL NOTICES.

The Editor will be glad to receive original communications upon professional subjects, travel, and personal experiences, etc.

Correspondence on matters of interest to the Corps, and articles of a non-scientific character, may be accepted for publication under a nom-de-plume.

All Communications or Articles accepted and published in the "Journal of the Royal Army Medical Corps" will (unless the Author notifies at the time of submission that he reserves the copyright of the Article to himself) become the property of the Library and Journal Committee, who will exercise full copyright powers concerning such Articles.

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Reprints or excerpts, additional to the above, can be furnished on payment if specially ordered at the time of submission of the article for publication.

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Each subscriber who pays his subscription direct to the Manager will also receive monthly a copy of "The R.A.M.C., The A.D. Corps, and Q.A.I.M.N.S. *News and Gazette.*"

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No. 3. March, 1939. Vol. LXXII.

Journal of the Royal Army Medical Corps

IN ARDUIS FIDELIS

ISSUED MONTHLY

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ASSISTANT EDITOR.
COLONEL D. T. RICHARDSON, M.C.

MANAGER.
MAJOR W. J. F. CRAIG, R.A.M.C.

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VOL. LXXII MARCH, 1939. No. 3

Journal
of the
Royal Army Medical Corps.

Original Communications.

R.A.M.C. FIELD TRAINING—THE CASUALTY CARD SCHEME.

By MAJOR-GENERAL R. W. D. LESLIE, O.B.E.

FIELD training of officers and other ranks in the R.A.M.C. is always a matter of difficulty under present conditions, as our chief mobile unit—the Field Ambulance—rarely materializes in peace time except at the Field Ambulance Training Camp at Aldershot, when a limited number of officers and men have an opportunity of seeing a complete field ambulance at work with all its equipment and transport. The tactical handling of several field ambulances—say of a division—can rarely, if ever, be efficiently practised as the peace-time establishment of the R.A.M.C. will not permit the liberation of more than a few officers and other ranks from their normal hospital duties.

As a result, in many exercises field ambulances are made up of a few officers and men—with motor ambulances to represent the dressing stations—and the ease and rapidity with which they move about give a false impression, not only to the Medical Services, but also to other branches of the Service.

It was with a view to finding some practical solution of this difficulty that the "Casualty Card Scheme" described in this article was evolved. It was decided at the outset to confine the scope of the scheme to lessons which can only be learned in the field in order to economize in personnel and transport; in other words casualties would be collected and evacuated, but treatment omitted. This raised the question of the provision of the necessary "casualties."

In certain exercises men are detailed from the fighting troops to fall out as "wounded" and are collected by the field ambulance stretcher squads; but this method, although it gives excellent practice to the bearers, means the loss of much valuable time to the "casualty," and for this reason is not popular.

If, however, a card is substituted for the wounded man the objection mentioned above is overcome, and, although actual carriage is omitted, the casualty has still to be "collected."

As already stated, it is practically impossible to get sufficient personnel to staff the field ambulances, and the minimum effective strength must be considered. If, therefore, each stretcher squad in a field ambulance is represented by one man, only nine men per company will be required for this purpose instead of thirty-six. As the casualty is represented by a card, one bearer (representing the stretcher squad) is quite sufficient to collect it.

Since treatment is not being practised, only three officers and a few other ranks are required to complete the establishment, and transport can be considerably reduced as technical vehicles are not necessary.

It is impossible, however, to get a true picture of the evacuation from A.D.S. to M.D.S. without the proper allotment of ambulance cars. Unfortunately these are expensive items and are not provided on a lavish scale in peace time, and to expect more than one or two with each field ambulance in an exercise would be unduly optimistic; but as only cards are being dealt with, any vehicle—even a private car—can represent a motor ambulance. (A suggested establishment for a field ambulance for the purpose of the scheme is shown in Appendix I.)

Finally—a sufficient number of casualty cards and some N.C.O.s or intelligent privates to represent R.A.P.s complete our requirements.

The working of the scheme is very simple. The casualty cards are marked "lying" and "walking" (*see* Appendix II) and are made up in packets of one "lying" and three "walking" (assumed proportions of these categories between R.A.P. and A.D.S.). A proportion of the cards can be marked with a green band to represent "Gas Casualties."

R.A.P.

The time of arrival and name of the unit are filled in by the N.C.O. at R.A.P. Cards are collected from R.A.P.s by the bearers of the Field Ambulance Company and taken to A.D.S. Only one packet of four cards (one "lying" and three "walking") may be carried by a bearer on any one journey from R.A.P. to A.D.S. As each bearer represents a stretcher squad, the "lying" card is the "stretcher case," and the "walking" cards represent wounded who find their own way to the A.D.S.

A.D.S.

At A.D.S. the time of receipt is filled in, and cards are divided into "walking" and "sitting."

Between A.D.S. and M.D.S. the proportion of "lying" cases will usually increase to 30 per cent of the total, but this complication has not been introduced.

From A.D.S. to M.D.S., cards are taken in motor ambulances or their substitutes. Only four "lying" cards or ten "sitting" cards may be taken in each vehicle on any one journey, or a proportion of "lying" and "sitting" corresponding to the normal carrying capacity of a motor ambulance. The time of departure from A.D.S. is entered on the cards immediately before they are handed to the driver.

M.D.S.

At M.D.S. the time of receipt is entered on each card and a record also made in the A. and D. Book.

Cards are finally collected at M.D.S. and checked with the number issued.

Once the "rules of the game" have been mastered there are many variations which can be practised.

The scheme is self-contained as regards the Medical Services and can be tacked on to any "G" or administrative exercises without causing embarrassment. Although primarily intended for exercises on a large scale, the "cards" will afford good training with single field ambulances, and in the Northern Command during the past training season all the Territorial Field Ambulances used them during their annual camps. The exercises in each case were of necessity confined to "a field ambulance working with an independent brigade," and the method of using the "cards" varied. In some exercises they were handed to R.A.P.s at intervals; in others the cards were put into sealed envelopes and given at the commencement of the exercise to the N.C.O. at R.A.P. with instructions to open them only at the times stated on the envelopes. Orders regarding moves of the R.A.P. were also included.

At the beginning of the exercise there was a tendency for bearers to walk too quickly and motor ambulances were inclined to travel faster than would be possible in actual war, but these mistakes were gradually rectified and, allowing for the fact that no treatment was being carried out, a reasonable picture could be obtained, and some valuable lessons were learnt.

"Gas casualty cards" were introduced in some of the exercises, and these helped considerably in the study of this important aspect.

In India the scheme was used with success on a comparatively large

scale in 1933, in a divisional signal exercise with skeleton formations of all branches. A certain amount of preliminary training of the I.H.C. personnel for the field ambulances had to be carried out, and it took some little time to make an Indian bearer realize he was representing a stretcher squad and what the cards meant; but once he had grasped the details he behaved most intelligently, and during the exercise it was interesting to note how he took advantage of cover and moved as though he were one of a squad actually carrying a case.

The cards were given to unit umpires at the commencement of the exercise with instructions to hand them to the N.C.O. at R.A.P. whenever a situation arose where casualties were likely to occur. The number to be issued at any one time was left to the discretion of the umpire.

The umpires played their part very well, and although over five hundred cards were given out this extra work did not interfere with their normal "umpiring." Eighty per cent of the cards were finally collected at M.D.S., but the length of time taken by casualties to reach their destination was illuminating, although the rate of progress was enhanced by the omission of treatment. The greatest difficulty was experienced in evacuating from A.D.S. to M.D.S., owing to the scarcity of good roads or tracks—except along a ridge exposed to heavy enemy fire—and apparently the only alternative was a very long detour. Dressing stations were not allowed to move until they had evacuted their casualties (i.e. casualty cards), and it was imperative, therefore, for field ambulance commanders to find a solution in order to keep up with the advancing troops. Eventually good reconnaissance brought to light a track along a dry river bed by which the ambulance cars were able to proceed with considerable saving of time and distance.

The fact that something tangible had to be collected and evacuated not only maintained the interest of all ranks in the medical services, but acted as a valuable check.

The earlier a wounded man receives adequate medical aid the greater are his chances of recovery, and therefore the chief role of the medical services in the field is not mere collection and evacuation, but adequate treatment. The amount of treatment which can be given, however, increases in direct proportion to the distance from the front line; since the more organized the medical work becomes the greater is the protection necessary for the patient and his attendants. Although the essential practice in treatment is omitted in the "Casualty Card System," the most rapid and efficient means of getting a casualty to a place where he can have adequate treatment requires considerable study and practice, and the cards, though a poor substitute for the real thing, will greatly help in this respect.

With the increased mobility of the Army, the problem of collection

and evacuation of wounded becomes more and more difficult, and while economy forbids the provision of more field ambulances for training purposes, any scheme which will enable the Medical Services to study problems in the field is valuable.

APPENDIX I.

SKELETON FIELD AMBULANCE.

(HEADQUARTERS AND TWO COMPANIES "A" AND "B.")

SUMMARY.

Detail	Officers	Sjts. or Cpls.	Privates	Total	Remarks
Headquarters	1	1	1	3	Equipment required:— Flag, pencils, A. and D. Book
,, attached (R.A.S.C.)..			9 (*a*)	9	
Two Companies	2	2	20	24	(*a*) 8 Drivers for ambulance cars, 1 motor cyclist
,, attached (R.A.S.C.)..			2 (*b*)	2	(*b*) Motor cyclists
Total ..	3	3	32	38	

COMPOSITION IN DETAIL.

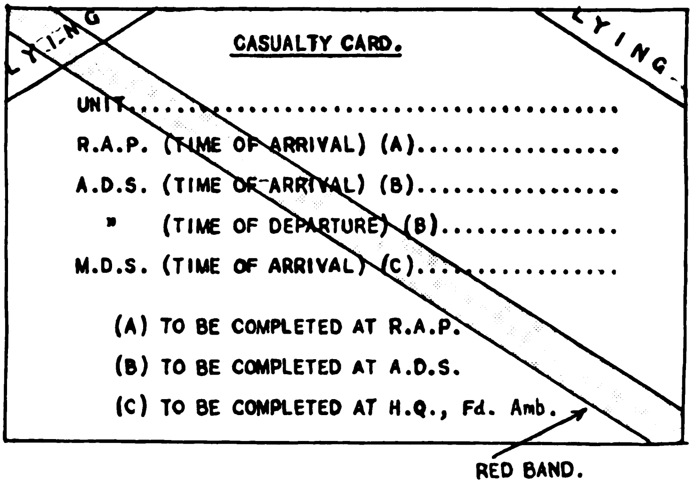
Detail	Officers	Sjts. or Cpls.	Privates	Total	Remarks
Headquarters—					
Officer Commanding	1	–	–	1	
Serjeant or Corporal	–	1	–	1	
Private (Clerk)	–	–	1 (*b*)	1	(*b*) Compiles A. and D. Book
Attached Transport Details (R.A.S.C.):—					
Motor Cyclist	–	–	1	1	
Ambulance Drivers	–	–	8	8	
Total, H.Q. ..	1	1	10	12	
Each Company—					
Officer	1	–	–	1	
Stretcher-bearers:—					
Serjeant or Corporal	–	1	–	1	
Privates	–	–	9 (*c*)	9	(*c*) Each Private represents a stretcher squad
Private (Clerk)	–	–	1	1	
Attached Transport Details (R.A.S.C.):—					
Motor Cyclist	–	–	1	1	
Total, Coy. ..	1	1	11	13	

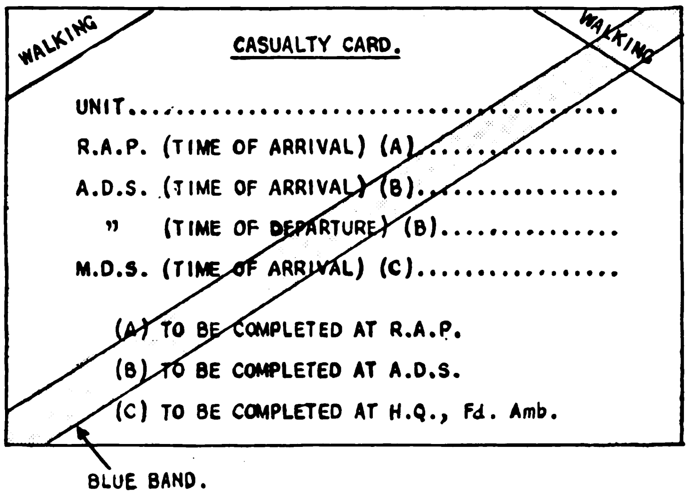
TRANSPORT.

Detail	Headquarters	Two Companies (each)	Total	Remarks
Motor Cycles	1	1	3	Officers provide their own motor cars
Motor Ambulances* ..	8	–	8	

* Or vehicles representing them.

APPENDIX II.


LYING
LYING.
CASUALTY CARD.
UNIT..
R.A.P. (TIME OF ARRIVAL) (A)................
A.D.S. (TIME OF ARRIVAL) (B)................
" (TIME OF DEPARTURE) (B)................
M.D.S. (TIME OF ARRIVAL) (C)................
(A) TO BE COMPLETED AT R.A.P.
(B) TO BE COMPLETED AT A.D.S.
(C) TO BE COMPLETED AT H.Q., Fd. Amb.


WALKING
WALKING
CASUALTY CARD.
UNIT..
R.A.P. (TIME OF ARRIVAL) (A)................
A.D.S. (TIME OF ARRIVAL) (B)................
" (TIME OF DEPARTURE) (B)................
M.D.S. (TIME OF ARRIVAL) (C)................
(A) TO BE COMPLETED AT R.A.P.
(B) TO BE COMPLETED AT A.D.S.
(C) TO BE COMPLETED AT H.Q., Fd. Amb.

TRAINING A (MECHANIZED) CAVALRY FIELD AMBULANCE—EGYPT, 1936.[1]

By Major J. Bryan Fotheringham,
Royal Army Medical Corps.

In January, 1936, No. 1 Cavalry Field Ambulance was formed at Crookham Camp, and proceeded to Egypt in early February as a "reinforcement" medical unit for that particular 1936 emergency.

On arrival in Egypt the unit was accommodated under canvas on a patch of desert at Helmieh some ten miles from Cairo. Although No. 1 Cavalry Field Ambulance was the first fully mechanized medical unit ever to leave England, the 2/3rd Cavalry Field Ambulance—also fully mechanized—had already been formed in Egypt and had proceeded to the Western Desert some time before our arrival.

We were more or less up to strength in N.C.O.s and men, but not so as regards officers. Our C.O. was Lieutenant-Colonel R. C. Paris, R.A.M.C., and he was supported by three temporary R.A.M.C. officers, a regular quartermaster and myself. In addition, we had attached to our unit a most efficient, zealous, and charming R.A.S.C. officer. Our Serjeant-Major and N.C.O.s were all serving soldiers, but with, I think, one exception, all privates were reservists serving on a six months' contract. This was the case with our R.A.M.C. personnel, and most of the R.A.S.C. were also reservists.

After our arrival at Helmieh on February 14 our transport gradually arrived, and we soon had quite an imposing car park.

As second-in-command of the unit my duties were practically wholly those of training officer, and I was glad that I had voluntarily taken a refresher course of lectures on gas a month or two before joining the ambulance. Not one of us had any idea how a mechanized field ambulance functioned. Perhaps I had better state here that I am making no remarks in this paper on tactical handling of a cavalary field ambulance. Unfortunately, as a reinforcement unit we never had a single opportunity of working with a cavalry brigade on any exercise, and also at a comparatively early date after our arrival in Egypt many of our officers and men were posted elsewere, either for temporary or permanent duty. On one or two occasions drafts of men from a general hospital in Alexandria joined us, and they received the same training that the original members of the unit had received. We made it a point in our

[1] A paper read to the Officers and Assistant Surgeons at the British Military Hospital, Murree, July 4, 1938.

training to change over N.C.O.s and men to the different jobs in the unit where this was possible.

I am not going into many details of the organization and equipment of a cavalry field ambulance. Full details regarding personnel, transport and equipment can be found in the Field Service Manual for the Medical Services of the Army, 1932, and from War Equipment Tables, etc. An excellent summary of the personnel, transport, etc., of a cavalry field ambulance is given in Chapter VII, Part II, of "The Army Medical Services in War" by Lieutenant-Colonel T. B. Nicholls, R.A.M.C. It will be sufficient to say here that a cavalry field ambulance is a small mobile medical unit and that it is divided into a headquarters and four sections.

The personnel and transport consist of ten officers, a hundred and sixty-seven other ranks and some forty vehicles.

The basic principles of our training were that the R.A.M.C. personnel should know the organization of a cavalry field ambulance, that they should have a sound working knowledge of the contents of the different panniers, and, in fact, of all medical and ordnance equipment, that they should know their first aid thoroughly, know how to load and unload lorries speedily, be able to open and close main dressing stations and advanced dressing stations, and that they should be thoroughly trained in defence against gas and in the treatment of casualties from gas.

It was equally necessary that our R.A.S.C. personnel should know the organization of the unit, that they should be proficient in the care and maintenance of their vehicles, that they should be trained in defence against gas, that as many as possible should have a good working knowledge of map reading, and that all should become expert at driving any type of unit vehicles over desert country.

We commenced training within three days of our arrival in Egypt, and the following is a list of training items carried out in the unit as far as the R.A.M.C. personnel was concerned. I doubt if it covers all our training activities.

Lectures and Demonstrations.

General hygiene, camp sanitation, etc. Sanitation in the field. Defence against gas. Treatment of gas casualties. Lectures on first aid, fractures, hæmorrhage, etc. Use of first field dressing and shell dressing. Unit mechanical transport. Field medical organization. System of evacuation from front line to base. R.A.P.s, A.D.S.s, M.D.S.s, and W.W.C.P.s. Transport of wounded by air. Forms and returns in the field. The Geneva Convention. Use of "Horrocks' box." The Harold-McKibbin method of water purification with chloramine (for officers). The Elliott mobile water purifier (for officers).

Practical Training.

A minimum of stretcher and squad drill. Regular P.T. exercises. Carriage of wounded by men—different methods. Bandaging and practical first aid. Preparation of waterproof sheet blanket-packet. Thomas splint and "stretcher splint" instruction. Loading and unloading motor ambulances. Loading and unloading "wounded" from a Vickers Valentia aeroplane. The use of the Neilsson pattern R.A.F. stretcher. (Type of "Universal stretcher sheet.") Construction of first aid and decontamination centres for gas cases. Pitching and preparation of operating tent, bell tents, etc. (frequently carried out wearing respirators). Loading and unloading unit lorries. Unpacking, checking, and repacking panniers, etc., and the use of their contents. Opening and closing M.D.S.s and A.D.S.s and selection of sites. Collecting and treating "wounded" in the field. Camouflaging of A.D.S.s. Night operations and bivouacking. Experimenting with a "Berridge" type of equipment for lorries. Map reading. Instruction in motor vehicle driving for selected R.A.M.C. personnel. "Ceremonial drill."

I think I should say here that our gas training was taken seriously. Every aspect of chemical warfare was studied. The care of our respirators was regularly carried out. We never opened an M.D.S. or an A.D.S. without making a first aid and decontamination centre down wind. Much work was done by the men when actually wearing their respirators. At my request, not theirs, they generally wore their respirators when I lectured them on chemical warfare!

Our training was carried out either in camp at Helmieh or at some spot in the desert anywhere between Cairo and Suez. We bivouacked out for a night in the desert on several occasions. This gave us practice in making our M.D.S. and A.D.S. in such a fashion that light could not be seen by hostile aeroplanes, etc. We frequently went runs at night along the Suez road, using only our side and tail lamps. Not nearly such an easy matter as it sounds, particularly on really dark nights! On moonlit nights we did a certain amount of desert driving. To drive expertly over desert country takes much experience. It is very easy to get "bogged" in soft sand. Drivers have to learn to avoid this, and if stuck in soft sand to know how to extricate their vehicles.

With regard to the training of R.A.M.C. personnel in driving motor vehicles, we tried this for a little but could get no official permission to carry on. Personally, unlike many officers in our corps, I do not think it feasible that we should have our own R.A.M.C. personnel driving and looking after field ambulance transport, although it might be useful if a percentage of the men knew how to drive. I found it quite simple to drive an 18 h.p. Austin touring car, fitted with large tyres, over the desert, but certainly

could not have passed any driving test when attempting to drive a 30 cwt. lorry—even on the level.

Although our 30-cwt. 6-wheeled lorries and 6-wheeled ambulances stood up well to the work they did over rough country, the general consensus of opinion was that we should have been better served with 4-wheeled Ford V 8 vehicles fitted with large "desert tyres." We considered that the motor cycles were adequate for intercommunication purposes, although they frequently broke down in the desert. The training of the R.A.S.C. personnel was effectively carried out by Lieutenant A. Provan, R.A.S.C., our attached R.A.S.C. officer.

A point I should like to bring in here is the answer to an obvious question. How long did it take to train this Cavalry Field Ambulance up to a standard when it was fit to take the field in actual warfare? I consider a fair answer to this is to say four weeks. We were inspected by the D.D.M.S., Egypt (Colonel J. H. Campbell, D.S.O.), four weeks after our arrival in Egypt. We "did our stuff" in camp and as realistically as possible in the desert, and were given an extremely good report by the D.D.M.S. for our efforts. I still think we put up a very decent show for him!

The "Stretcher Splint."

I have mentioned earlier that the R.A.M.C. personnel were given instruction in the application of the Thomas splint and in the "Stretcher Splint." An explanation of the latter is necessary as few people seem to know it. In late 1918, when I was with a field ambulance in the 7th Division, one of our officers produced a cutting from some medical journal explaining how a stretcher could be used to provide extension in the case of a man with a fractured femur, where no Thomas splint was available. We were out of the line at the time and practised this method with the help of some of our men. I do not know who first called it the "Stretcher Splint," but I have always used that term myself. During the last "push" in Italy in 1918 I was running an A.D.S. and my stock of Thomas splints ran low; I then used this method of extension on one or two German or Austrian prisoners with fractured femurs, and with satisfaction to both sides.

Personally, I consider that all R.A.M.C. personnel should know this method. It is *not* meant to supplant the Thomas splint, but there are many occasions in war when one just cannot raise a Thomas splint when it is required. A patient with a fractured femur can be first-aided by this method until such time as he can be put up on a Thomas splint.

Fig. 1 shows a man on a "Stretcher Splint" side by side with a comrade put up on a Thomas splint. It is a very simple method, not so painful or so brutal as it looks, and can be carried out by two men.

The details of applying this substitute for a Thomas splint are as follows:—

(1) A clove hitch with a bandage or puttee is placed round the foot of the injured limb and fastened to a near pole and runner of the stretcher.

(2) The sound limb is bandaged loosely to the injured limb.

(3) Large pads are then placed in each axilla.

(4) Wide bandages are placed over these pads and tied in half knots over the shoulders, then crossed under the patient's head and tied loosely to the stretcher poles.

(5) The foot end of the stretcher is then raised until the stretcher is perpendicular. The weight of the patient gives extension which is

FIG. 1.—The "Stretcher Splint."

increased by tightening the two shoulder bandages. These are now securely tied to the stretcher poles and runners.

(6) The stretcher is lowered, the wound dressed, and Gooch splinting if available applied.

(7) Pads are placed between the ankles and knees. The bandage already round the ankles is tightened and a broad bandage placed firmly round both knees.

(8) A figure-of-eight bandage is then applied round both feet and fastened off to both handles of the stretcher.

If rough ground has to be traversed, then a broad bandage can be placed round the stretcher and patient at the level of his hips and securely tied.

Note.—It is important that the clove hitch be made with strong material, and the knots very securely tied. Otherwise, when raising the stretcher to a perpendicular position, a worse accident than a fractured femur may occur to the patient. He could easily sustain concussion or a broken neck.

The larger the pads in the axillas the less pressure there will be on the axillary arteries.

I have purposely not given a list of bandages of definite lengths and description as this is pointless where improvization may be essential.

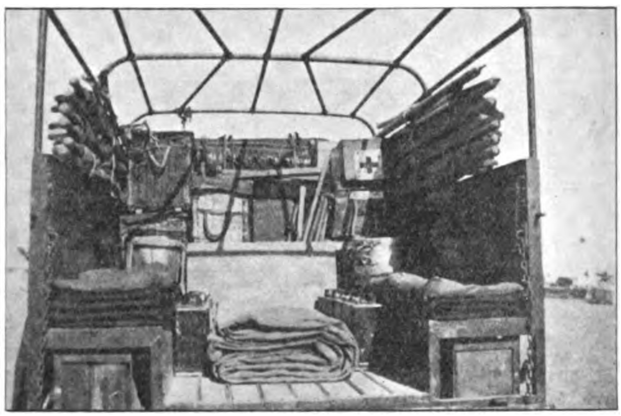


Fig. 2.—Section Lorry Load.

Loading of Vehicles.

Much time was spent in practising the loading and unloading of vehicles. There was very little difficulty in doing this with headquarters' lorries, and no special method of packing these vehicles was evolved. It was a different matter with the section lorries, as a section lorry carries eight men and all the section equipment. Carelessly loaded lorries driven over rough country lead to damage of equipment and considerable discomfort to the personnel carried in the lorries. We found that to make satisfactory advanced dressing stations we had to carry some additional equipment. Our section lorries had a load capacity of 30 cwt., and they carried between 27 and 28 cwt. for many weeks without difficulty over very rough country. Strictly speaking, we had no right to carry more than 75 per cent of a vehicle's load capacity.

An average time for a section's personnel to load a section lorry was three minutes, and our best time was two minutes fifteen seconds.

Fig. 2 shows our method of loading a section lorry.

The additional equipment that we carried weighed 75 pounds and consisted of the following items:—

	No.
Cordage, manilla, hawser, 1½ inches by 36 feet	3
Lashings, tarred, 1½ inches by 15 feet	10
Pins, tent, steel, large, 3 feet	3
Poles, tent wall, 6 feet (Mark III)	3
Line, natural sisal, ¾ inch by 5 feet	4
Pins, tent, iron, large, 15 inches	2

It is possible that by this time a gas treatment pannier, pyjama suits and bleaching powder may form part of a section's lorry load.

Formation of Main Dressing Stations.

Before giving details of the methods we adopted in forming M.D.S.s and A.D.S.s, I must mention something about "covers, waterproof, black, G.S. 30 feet by 20 feet." In the Field Service Manual for the Medical Services, 1932, 8 of these are shown, 4 for headquarters and 1 for each section.

In Colonel Nicholls' book (page 113) he gives 5 as the total number, 1 for headquarters and 1 for each section.

The waterproof covers drawn by No. 1 Cavalry Field Ambulance in England were approximately 30 by 30 feet, and their weights varied between 161 and 252 pounds, depending on the amount of impregnated tar. They were black, dirty, unwieldy to handle, and when in use soon showed signs of wear. When used to form the roofs of our A.D.S.s they must have shown up beautifully from the air. We exchanged all but one of them in Egypt for green rot-proof canvas covers, weighing "officially" 190 pounds, but actually weighing about 150 pounds. We found these new covers very satisfactory and very much easier to handle. The old black covers looked to me to be similar to the type of covering one sees over railway goods wagons.

Now for our type of main dressing station. It was a very simple affair. On arrival at the site selected for a M.D.S. four lorries were placed end to end so as to form two sides of a square, and then a 30 by 30 feet canvas cover was drawn over their tops to form a roof, which was prevented from sagging by a criss-cross arrangement of ropes fastened to the lorry roofs. While this was being constructed the operating tent was pitched and the gas panniers placed at the site chosen for the first-aid and decontamination centre for gas cases. For this purpose we had retained one of our old black tarpaulins, which was painted in white, showing the different "rooms" of the decontamination centre. It was very useful for instructional purposes. When our large red cross on its white background had been pegged out, panniers, etc., unpacked, operating tent equipped, evacuation centre completed (the same pattern as our section A.D.S.), cookhouse functioning, the remaining headquarters transport in line, and the latrine and urine pits dug and screened, the M.D.S. was then ready to receive casualties.

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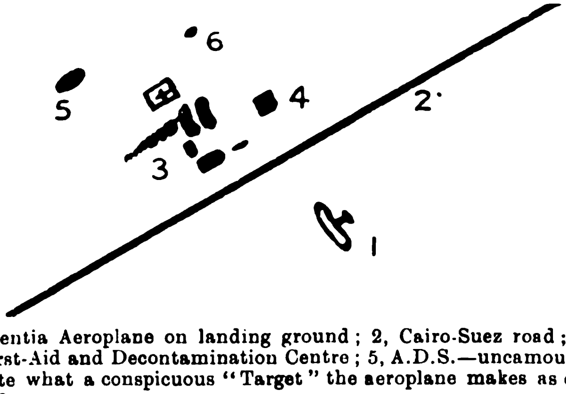
FIG. 3.—M.D.S., etc., from 4,000 feet.



1, Vickers' Valentia Aeroplane on landing ground; 2, Cairo-Suez road; 3, Main Dressing Station; 4, Gas First-Aid and Decontamination Centre; 5, A.D.S.—uncamouflaged; 6, A.D.S.—camouflaged. Note what a conspicuous "Target" the aeroplane makes as compared with the camouflaged A.D.S.

It took us on the average thirty minutes to form a M.D.S. from the time of arrival of the Headquarters at the M.D.S. site.

Fig. 3, taken from the air at 4,000 feet, shows the lay-out of our M.D.S.

If considered necessary to form a more elaborate main dressing station than the standard one of our unit, then a receiving section, mortuary, etc., could easily be formed with the 30 by 30 feet canvas covers, plus the small additional equipment we used in forming our A.D.S. shelter. However, the policy in a mobile unit must be to try to cut down loads and not to increase them.

Advanced Dressing Stations.

An A.D.S. could be opened in fifteen minutes by a well-trained section. That is from the time the section lorry with its equipment and personnel arrived at the selected area. Our expert in the formation of the particular type of A.D.S. shelter we eventually found most satisfactory was Lieutenant (now Captain) J. Shields, R.A.M.C. The principle was to use the lorry canvas hood to form a lean-to shelter on one side of the lorry, to secure the 30 by 30 feet canvas cover to the lorry roof and to carry the cover away from the lorry on three ropes which acted as ridge poles. These ropes were attached to three poles securely fixed in the ground. They prevented the roof from sagging too much and helped to increase the head room available in the shelter. The sides of the canvas cover were then pegged down.

After much practice it was pitched more or less as a drill. The section serjeant and four R.A.M.C. privates erect the shelter and the lean-to, while the two corporals unload the equipment through the side of the lorry from under the cover and then unpack it. As stated before, the personnel of the section is one R.A.M.C. officer and seven R.A.M.C. Other Ranks:—

One serjeant for regimental duties.
One corporal for clerical duties.
One corporal for nursing duties.
Two privates for nursing orderlies.
One private for cook.
One private for batman.

Then there are the three R.A.S.C. drivers, one for the section lorry, one for the two-seater Austin car, and one for the section motor cycle used for intercommunication. As soon as the section reaches the site for an A.D.S. the first duty of the R.A.S.C. drivers is the care and maintenance of their vehicles. Actually, they generally gave a hand at putting up the A.D.S., and this was a help on a really windy day. The ground area covered by our A.D.S. was 115 square yards.

It is considered that 30 by 20 feet covers are too small, and anything above 30 by 30 feet too large for the personnel of a section to deal with.

Such an A.D.S. can be closed and the lorry loaded with equipment and personnel in ten minutes. I think our best time was six and a half minutes.

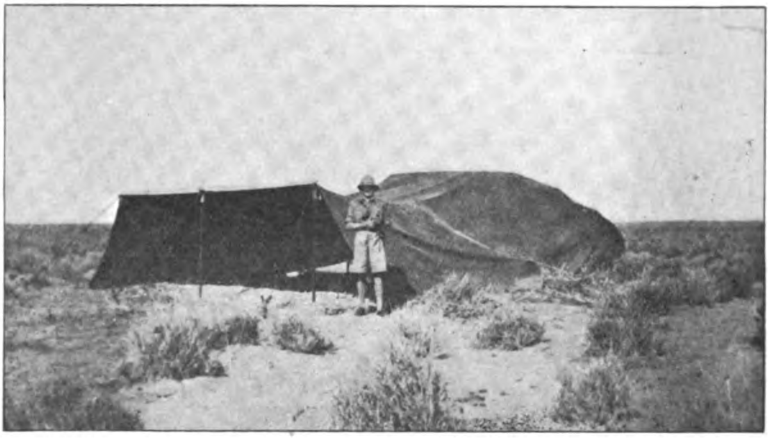


FIG. 4.—Uncamouflaged A.D.S.

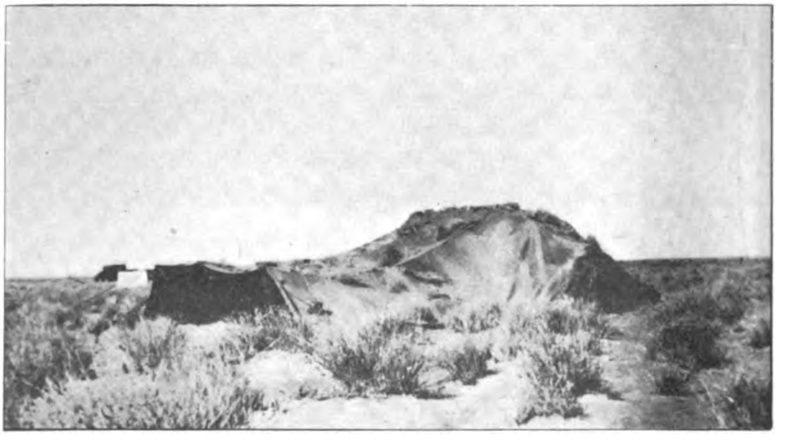


FIG. 5.—Camouflaged A.D.S.

CAPACITY OF A.D.S.

It easily provided "head cover" for the three section vehicles, and comparatively luxurious living accommodation for the section personnel when not receiving casualties.

As an A.D.S., it could accommodate 18 to 20 stretcher cases, 12 walking wounded and the personnel of the section. This still left sufficient room

for the section personnel to dress "wounded" and have access to the equipment. The head-room was adequate.

If used as the evacuation section of the M.D.S. it could accommodate 57 patients (27 stretcher cases and 30 walking wounded).

Under lorry lean-to portion	16 walking wounded.
In interior of lorry	12 walking wounded.
On lorry front seat	2 walking wounded.
Under canvas cover	27 stretcher cases.
TOTAL ..	57 patients.

Note :—Two bearers can remove 27 stretcher cases from under the canvas cover in five minutes; for example when M.A.C. ambulances are clearing the evacuation section of the M.D.S.

It may be considered that I have unduly stressed my remarks about these canvas covers, but I think we must presume that in mobile warfare there will be numerous occasions when there will be no buildings which can be utilized by a cavalry field ambulance for M.D.S.s or A.D.S.s. Our type of A.D.S. was not an elaborate affair, and compared with some of the A.D.S.s. formed in static warfare where R.E. aid and plenty of material were available, was really only a collecting post. On Gallipoli in 1915, I saw something of the suffering of wounded men lying in rows under a strong sun, and the type of A.D.S. that we formed in No. 1 Cavalry Field Ambulance at least does give :—

(1) Protection from sun, rain, and to some extent from cold.

(2) Some protection from dust and wind.

(3) Some protection against being "spotted" by hostile aeroplanes if well camouflaged and well sited.

(4) Temporary protection from mustard gas sprayed from the air.

WALKING WOUNDED COLLECTING POSTS.

We made no attempt to form W.W.C.P.s. As stated in para. 217, R.A.M.C. Training, 1935: "During mobile warfare, separate arrangements for the collection of walking wounded will seldom if ever be made."

CAMOUFLAGE.

We were never able to find out the policy about camouflaging or otherwise of advanced dressing stations. I was very keen to ascertain whether our particular type of A.D.S. could be camouflaged from air observation or not. It appeared to me that although we might demonstrate to the enemy that the M.D.S. was a medical unit, the A.D.S. would have to take its chance. If the tops or roofs of our A.D.S.s were each covered with a large red cross on a white background, then they might give hostile aeroplanes information regarding the concentration of troops. On the

other hand, we knew how difficult it was for mechanized vehicles to avoid being seen from the air.

In late April, 1936, the Officer Commanding No. 208 (A.C.) Squadron, R.A.F., kindly agreed to have our unit photographed from the air, so one afternoon we proceeded some thirty miles along the Suez Road and bivouacked near No. 2 Landing Ground, Suez. There we formed our usual type of M.D.S. on bare sandy ground, and then placed two A.D.S.s near by in scrub.

One A.D.S. was uncamouflaged and of our by then stereotyped pattern (fig. 4). The other was formed of a canvas cover previously painted by ourselves in the usual camouflage manner suitable for Egypt. Unfortunately, we could not paint the lorry hood cover as well. It would have taken ages to get permission! We made this A.D.S. as low as possible, and in such a manner as to give the minimum amount of shadow. We tied bits of scrub over it and threw sand on its roof (fig. 5). Finally we brushed over all adjacent wheel tracks, as we knew that these frequently showed up quite clearly from the air.

The following morning No. 1 Cavalry Field Ambulance was photographed from the air at 4,000, 6,000, and 8,000 feet. Fig. 3 was taken at 4,000 feet. From this photograph it is possible to see a considerable difference in the appearance from the air of the two A.D.S.s. The dark portion of the camouflaged A.D.S. is shadow thrown by the lorry and lorry lean-to.

A few days later I visited No. 208 Squadron at Heliopolis and talked to their expert in aerial photography about the aerial photographs of our unit. He gave me the following information—some of which I already knew and some which I wished I had known :—

(1) That in Egypt shadow was the greatest difficulty when trying to camouflage anything.

(2) That with a larger canvas cover and making the A.D.S. tortoise-shaped and tapering all round, the A.D.S. would then probably have been invisible at say 4,000 feet.

(3) That shadow could be camouflaged to a considerable extent by spreading something like "dirty" whitewash here and there over the shadow area.

(4) That the A.D.S., situated as it was in scrub, would probably not have been spotted by an enemy observation plane flying at about 8,000 feet, and might easily have been missed by an observer flying at a considerably lower height.

(5) That it was very important to pick a good site, shadow of hills, etc.

(6) That our camouflaged A.D.S. was a very good piece of camouflage for a first attempt.

The R.A.F. officers I saw were astonished at what, if the necessity arose, the "contents" of our A.D.S. could be.

Unfortunately, we were never able to carry out any further experiments in camouflage as shortly after this our unit began to break up, and training became increasingly difficult to arrange for.

CONCLUSION.

I have endeavoured in this paper to give more or less in detail how No. 1 Cavalry Field Ambulance was trained. We were never put to any practical test which might have shown where our training was defective. I feel now that more attention should have been paid to map reading for R.A.M.C. personnel. We had a class for officers and there was some training for the R.A.S.C. personnel. As a unit we were essentially mobile, and I think we were fairly efficient. I know that we were all very keen.

There are many points in connection with a Cavalry Field Ambulance which I have left untouched, particularly the very important one of its tactical handling in mobile warfare. The organization and equipment, etc., of this type of unit may already be very different from what it was in 1936. If so, I wonder if one section is now equipped solely for the treatment of gas casualties and decontamination? Whether all 7-H.P. Austin cars have now box bodies? (Section Austins could carry extra petrol, gas treatment pannier, chloride of lime, etc., beside the section officer's valise!) Whether small Austin box cars could possibly be fitted with some gadgets so that, if necessary, they could carry one or two stretcher cases? Is there now wireless for intercommunication purposes as well as motor cycles? Lastly, have those "urinals, glass, plain" been scrapped?

I am indebted to Major H. W. Daukes, R.A.M.C., for the photograph of the "stretcher splint"; to O.C., No. 208 (A.C.) Squadron, R.A.F., for the aerial photograph; and to Lieutenant-Colonel R. C. Paris, R.A.M.C. (R.P.), for photographs Nos. 4 and 5.

THREE CASES OF ABDOMINAL PAIN.

By Lieutenant-Colonel J. C. A. DOWSE, M.C.,
Royal Army Medical Corps.

A casual conversation with a well-known Professor of Gynæcology who is deeply interested in the problem of abdominal pain in the female, coupled (perhaps) with indications in my own abdominal viscera that multitudinous "eats" at a sherry party are not conducive to digestive comfort, have prompted me to relate the story of the following cases which came under my observation on the same night.

I was doubtful whether I should head these notes "A Night in the day of the Owner (in the Naval sense) of the Louise Margaret," or "One can never tell, can one?"; both appear to me to be apposite.

One case has a definite bearing on the manifestations in the female that are of interest to the Professor before mentioned, whilst the other two have points of professional interest and just interest (to me). All of them occurring on the same night bring them into parallel as cases of abdominal pain; unfortunately the second principal is not a female, and, in any case, from the nature of the ailment and age would not come into the scope of the Professor's type of inquiry, even if he (the case) had been his own sister.

Owing to the fact that it was a Saturday, October 1 to be exact, the "Owner" had so far neglected his duties as to play a game of golf during the afternoon. To make up for this unusual (!) lapse and to salve his conscience (thank you, Mr. Reader, but I have heard that one before) he had been attempting to clear off arrears of work in the office by answering one or other of the "URGENT" messages from the War Office, in the hope that if the correspondence could be introduced into the Central Registry on the Sunday it might reach the "intermediate host" by at least Tuesday, and so arrive at its final destination still answering to the label "URGENT."

The time was 10.30 p.m. and thoughts of a final pipe and then a hot bath were occupying his mental horizon.

A knock at the door of the office and a voice saying, "Please will you see a woman who has just been admitted, also a child with a pain in its abdomen, and did I know that my Mrs. X had come in and had started labour?" The answer to the first two questions was in the affirmative, the last "bless her" (obviously an instance of the foolishness of being in the right place at the right (or wrong) time).

At the end of the corridor I could see the figure of a woman being assisted by a man, the figure was bent double and proved to be the new case No. 1, accompanied by her husband.

On arrival in the ward duty room, she exhibited signs of abdominal distress, clasping her lower abdomen with both hands and announcing that she had a pain. At least I gathered that that was what she was trying to convey; her speech had not altered since she had developed a strong Anglo-Hebridean accent in her youth. (Though a Celt myself I find it hard, at times, to tune into the strange tongues of Scotia.) The Ward Sister also found that it was difficult to render the Doric to more understandable English and made a mistake in the location of the lady's address. The potential patient rose smartly from a chair in which she was seated and with the speed of the framechange of a cine camera proceeded to inform us, in the aforementioned dialect, just where her home was both in the Hebrides and in Aldershot. I was struck by the fact that the pain, which appeared to be so overwhelming the moment before, now seemed to have faded into the background. For one unworthy moment I thought that we were dealing with a case of Czecho-Slovakitis, her husband belonging to a Regiment under twelve hours notice to proceed to that country. There had been several instances of opportune diseases amongst the wives of men under orders for abroad.

When the voluble explanation ceased I attempted to find out why she had come to the hospital and who had sent her there. The answer to the last was that no one had; she had not been seen by a medical officer.

In the intervals of the rambling and irrelevant statement that followed, I elicited the fact that she was a married woman of some eighteen months standing and to her eternal shame she had not presented her husband with a son, as all good Scots wives should——No, she had never shewn any signs of so doing, though she had always been a "rare healthy lass with never mair than a strang whoop as a chile"——Did I think that at the age of twenty-six, after being married for such a long time, that she could never have a bairn? I asked leave for notice of that question.

However remiss she had been in this department of her wifely duties she was proud of her house and I gather, spent a large portion of her time in attending to the cleanliness of this wee hoose. (Two tiny rooms and a minute kitchen in the "blood-sucking area" of Aldershot, so-called from the vampire-like propensities of the local species of landlady.)

For a few days before coming to the hospital she had been feeling seedy with indigestion but she attributed this to a "gastric stomach" (and not as far as I could gather to her own cooking). The gastricness of her stomach usually troubled her a little when her "monthly" came on, as it had, up to time, on September 25; she had noticed, however, that it was lasting longer than her usual four to five days——No, she never took much notice of the monthly, as apart from the aforementioned gastric condition she never had very much discomfort.

On the previous morning, September 30, whilst engaged in the essential

duty of scrubbing the floor of her kitchen, she was smitten by a "strang" pain just below her breast bone (no suggestion on my part could shake her from maintaining that this was the original site of the pain). She could not rise to her feet and crawled to a chair and thence, slowly to her bed, where she lay down for a while. She then felt very sick, and vomited (here followed a description, in detail, of the vomit). After this she felt rather better though unable to get up and cook her husband's dinner. (The pain must have been very severe for such a good housewife to be incapable of preparing her man's food.)

Her husband returned for his mid-day meal to find his spouse prostrate, now complaining that the pain, once epigastric in location, had moved to the right side of her tummy. After the inevitable cup that cheers but does not inebriate, she felt comforted and in spite of some pain during the afternoon and evening, she passed a fairly comfortable night.

The next morning, the pain, still there, was so much easier that she was able to get up and do her work. The day passed in much the same way but towards the evening she felt that the state of affairs had taken a turn for the worse and her right side (tummy) was very sore.

In consultation with her husband and dispensing with the services of a medical officer, the twain decided that she had got appendicitis and that she had better go to hospital without more ado. The logic of their argument being centred round the fact that he (the husband), two years previously, had had a pain in the same place as her pain; this had led him to the operating theatre and it had been called appendicitis. I suggested that they might have formed their opinion by reason of possessing a copy of "The Home Doctor," a suggestion most indignantly denied. Actually an offer (not accepted) was made to demonstrate the fact that the scar on her husband's abdomen was in the same place as the tender spot on hers!

During the rare pauses in this garrulous young woman's recitation, Sister managed to elicit the fact that her temperature was 99° and her pulse-rate 88. I made the suggestion that she should stay with us for the night and if she would get into bed at once I would try and see if her diagnosis was correct, assuring her that if I agreed with her, I would undoubtedly put her on level terms with her husband as to scars on the tummy. This seemed to comfort her.

I found that there was, unquestionably, a tender spot just below the historic landmark of McBurney and a little towards the mid-line. There was very little guarding of the rectus.

I was frankly puzzled and not at all certain that her diagnosis *was* correct.

I then attempted, mentally, to tabulate the salient features of her story and found it difficult to complete the jig-saw (as I am sure the reader has already discovered). It seemed to add up to a sudden epigastric

pain following a few days indigestion, the pain moving to and remaining in the R.I. fossa. The pain easing after the first violent outburst and then returning, to become nagging but not so severe, finally that she had started to menstruate six days before the first pain, which was then about thirty-six hours old.

At this moment a pathetic appeal came from the children's ward, saying that the parents of the sick child and the S.S. and A.F.A. sister (who had come in with them) were still waiting, could I possibly come and deal with them.

I accordingly left my "chatty bits," giving instructions to the Sister to take an hourly pulse and temperature. (I had pity on the Lab., as it was then 11 p.m.) I promised to come back in a short while and continue my investigations when I had seen the child upstairs.

I got heavily involved with this case (which see later) and did not return to see the lady for nearly two hours or about 1 o'clock.

I then found that there had been a rapid change in her condition, her pulse had gone up to 108 and was thin rather than bounding. Her tummy was much more resistant whilst the pain in the R.I.F. was definitely worse. She did not look toxic but had a worried look, her skin was a little moist but she was not sweating.

I decided to dispense with any further examination, as though I was not completely convinced that her now, obviously, acute abdomen was due to an appendix, I was satisfied that it was a condition that would not warrant any further delay.

I told her that she would have to be operated on and that she might have an appendix that required looking at. She remarked "You're quite right doctor, my husband says it is" (what sublime faith !).

I admit the sin of omission in not making a vaginal examination but I felt that it would not have altered, though possibly confirming, the impression already formed that her abdomen must be opened for a "look see" or Indian dechko.

As the theatre was ready (I had just operated on Case No. 2) I was able to start investigations straight away.

A right paramedian incision gave access to the abdomen. No one will persuade me that a muscle splitter is sound in the female, you never do know what you are going to find and you may want an eight-inch incision before you are done.

The answer was soon there for all to see, bright red blood welled up into the wound, the appendix was normal, but there was an early ectopic pregnancy which had ruptured. The right tube was swollen near the fimbriated end to the size of a large grape, blood was oozing from the distal end. The rest of the pelvic viscera were normal. The tumour was removed and the patient sent back to her bed as soon as was conveniently possible, apparently little the worse for her ordeal.

Her convalescence was without (medical) interest but she was a constant source of amusement to the anglican co-patients in the ward, who enjoyed her somewhat broad Scots humour and sympathized with her in her mistake in the diagnosis. She countered this with "Weel, I'm no sure that the Doctor kenned either!" Astute young woman!

Amongst the points of interest in this case was the peculiar epigastric pain. This is easily understood had the case been one of genuine appendicitis, when the phenomenon of primary epigastric pain, later locating itself in the right iliac fossa is common.

The tube and the appendix are developed, embryologically, from different structures, the tubes being mesodermic and the appendix entodermic. Their blood and nerve supply are quite distinct. It is hard, therefore, to find any relationship on these lines between an epigastric pain and a tubal pregnancy. I feel that the solution of the problem was that some peritoneal irritation, caused by the rupture of the tube, induced a general abdominal pain so severe that it appeared to be in the epigastric region as well as elsewhere and eventually settled down to the immediate locality of the tube.

Perhaps some reader will help me to find out why Scottie had the epigastric pain!

I think that one can eliminate the possibility of a lesion in the stomach itself. Subsequent observation on this point showed no sign of true gastric abnormality. The "gastric stomach" was better the next day and did not trouble her during her twenty days of convalescence.

Needless to say the first sensation at finding free blood in the peritoneal cavity and no lesion in the appendix, was one of chagrin at missing the diagnosis, combined with a feeling of thankfulness that the instinct for the necessity of the laparotomy had won the day.

The dictum attributed to Mr. Victor Bonney that the true art of the gynæcologist lies not so much in the making of an accurate diagnosis of pelvic abnormality as in the knowledge when to open the abdomen, was well illustrated, though the artistry in this case may be open to doubt.

It is, perhaps, a fortunate thing that so much of the abdominal pain to which the human female of the species is heir occurs on the left side or there would be scarcely a woman alive who could boast of retaining her appendix by the time she reached the age of 30 years. I have known of appendices removed for right-sided pain that made the surgeon think very hard (subsequent to removal) to find a reason for the removal.

When the tube was examined the embryo was found to be somewhat separated from the yolk-sac, which would place the age of the embryo at not less than 14 days.

Unfortunately the examination was a macroscopic one and therefore a definite diagnosis of the stage of development was not made. The

appearance of the embryo seemed to fit in with a life of about 14 days. As mentioned before there had been no history of amenorrhœa and in fact some bleeding per vaginam had started before she had the attack of pain. This is in itself a reversal of the normal sequence of events, where the rupture of an ectopic is *followed* by vaginal loss, at times severe but more usually slight. Casts of the uterine mucosa are not uncommon, but no such phenomenon was noticed at any time in the case under review. A slight vaginal discharge persisted for about six days after the operation.

The second incident in the "night" strikes a different note and suggests the question of heredity versus coincidence.

A child, aged 6 months, the second son of his parents, arrived at the hospital at the same time as the Scots lassie, accompanied by both parents and the Sister from the Welfare Centre.

The story (I give it as a mixture of the statements of the parents and the Sister) was that Bobbie had caused the usual commotion in the morning of that day by demanding food; his appetite appeased, he accomplished his matitudinal evacuation of the bowels without fuss or bother. He was his normal, rather energetic self and a healthy well-nourished child. A little later, about 9 a.m., his mother gave him a few spoonfuls of Quaker Oats—which his "soul" loveth—as he still seemed to be hungry. The oats were gratefully absorbed. Bobbie was put in his cot whilst mother got on with her job of cleaning up the house. Shortly afterwards mother was alarmed by a sudden scream from the child and found him howling lustily, with his legs drawn up, apparently having a severe pain in his tummy. Rather frightened, she tried with no success to comfort him, bundled him up in a blanket and took him to the Welfare Centre, where dentition defects appeared to be the trouble and a teething powder the answer. (What miraculous powers are invested in our pharmacological remedies!) The babe seemed easier during the morning, but was constantly whimpering and unlike himself, he vomited twice.

In the evening, still unhappy about his condition, the mother sought further advice, when it was decided to give him a saline washout. The saline returned clear, except that there was quite a quantity of bright red blood and a little mucus which followed the expelled saline. The infant was looking ill. The medical officer decided on the chance of an intussusception and advised hospitalization. So far not an uncommon type of case, but now the coincidence. Two years before his elder brother at the age of 9 months had produced exactly the same symptoms very suddenly, treatment had been on the same lines; there had been some improvement followed by a rapid collapse; operation, an intussusception released, but eight inches of gangrenous gut had to be resected; the child died a few days after operation. This story was vouched for by the S.S. and A.F.A. sister who knew of the circumstances that had brought the elder child to

hospital, and the operation was confirmed by reference to the hospital operation book.

Was the second child a similar case or was it the natural fear on the part of the parents and the medical officer that it might be so? The medical officer had been guarded in his opinion and had marked the A.F.B. 247 intussusception? I examined the child and entirely agreed with him.

Obviously distressed, with "abdominal facies" and shrunken eyes, I could find none of the classical signs of an intussusception, no tumour could be felt (it is never very easy without an anæsthetic to feel even a fair-sized swelling in a child who is crying all the time), there were no peristaltic movements visible or discernible to the touch, the abdomen was flacid during the brief moments during which the child ceased to cry, he had vomited but twice and that early in the morning, it was now 11 p.m. His bowels had not opened since his motion in the morning and there had been no sign of blood or mucus per rectum except after the wash-out mentioned above. Rectal examination gave no information, there was no blood on the examining finger. The Signe de Dance was absent, the R.I.F. seemed to be normal.

In spite of the lack of positive signs and symptoms leading to a definite diagnosis, the babe was ill, very ill, pulse thin and rapid (140), subnormal temperature. An abdominal crisis out of the ordinary.

I attempted the method of treatment of giving a high rectal saline under slight pressure, which once in a while blows out an intussusception as air does the finger of a glove in the state of intussusception. This had no effect on easing the abdominal distress. After all the saline had been forcibly ejected there followed a small quantity of blood. I felt then that I must hunt for an intussusception.

I told the father of the gravity of the situation; he implored me to operate at once "in case the intestine went black as it did with the other child."

It is not often that one is implored to operate, it frequently happens that there is difficulty in obtaining permission to do so unless one can demonstrate something tangible to the lay mind such as a swelling or a broken and deformed limb.

Much to the delight of the Sister "on call" for the theatre (by now in bed), Theatre Sister herself appeared, having just returned from her "half-day" and the pictures.

The theatre was accordingly ready in the usual twenty minutes.

Before bringing the babe to the theatre I could not locate the intussusception in the ileo-cæcal region which, according to Adams, is the site of 35 per cent. of cases, i.e., the true ileo-colic variety (where the ileo-cæcal valve and the lower part of the ileum are received into the colon. The

tumour then has colon outside (ensheathing layer), the ileo-cæcal valve and the cæcum inside this (returning layer), and finally the lower part of the ileum internally or entering layer). It was decided, therefore, to make a midline incision just below the umbilicus. (*En passant*, it is peculiar how very pale the abdominal fat is in a small child.) The anæsthetic was a C.E. mixture.

The ileo-cæcal region was, in fact, clear, the cæcum rather blown out but the descending colon was collapsed. A small early intussusception was located near the splenic flexure, about three inches in length. It was not difficult to restore the gut to its proper alignment. The mesenteries of the entering layer and the returning layer were engorged and rather blue, but rapidly recovered when the pressure was released; the gut itself was injected but healthy. I felt that the effort to reduce the intussusception with the high saline must have very nearly succeeded. The operation, however, had been justified as the reduction was not complete. My relief on finding the constriction was commensurate with the relief of the bowel on being derestricted. With a satisfied mind the abdomen was closed, after a hasty look round to see that there was only one intussusception.

The type of lesion thus proved to be of the colonic variety, a much rarer form than the ileo-colic.

I was a little surprised that, even under the anæsthetic, I could not feel the curved tumour before I opened the abdomen, but as Adams remarks that blood and mucus passed without fæcal matter is almost diagnostic of the intussusception type of obstruction, provided that one can eliminate such conditions as Henoch's purpura, etc., I felt that to refuse laparotomy was not justified.

The change in the condition of the child the next day was most marked; gone was the sunken-eyed, anxious look, and in its place was an appetite which was difficult to satisfy and yet keep within reasonable limits. The operative shock, which is so often a serious matter in such tiny beings, appeared to be absent. The bowels opened normally the following morning; there was a trace of altered blood.

The child's progress was like the proverbial "house on fire" when the water mains are frozen.

It was fortunate, perhaps, for this child that the coincidence of his brother having a similar illness led to his early treatment. If diagnosed and treated (by laparotomy) within twelve hours or less the chances of recovery in a previously healthy infant are reasonably good; after that, every moment of delay may make a vast difference.

I cannot think that there can be any "tendency" from the heredity point of view for brothers to develop this condition; the records do not point in that direction.

The disease is undoubtedly one of infancy, being preponderately common in children under 1 year of age, nearly 70 per cent; and of these the affliction occurs much more commonly in boys.

During the time that I was engaged on these two incidents I made a few rapid forays to cast a knowing eye over "my Mrs. X." Labour had undoubtedly started and seemed to be progressing normally. The burning question was would Mrs. X wreck the proceedings by getting into the second stage before incidents No. 1 and No. 2 could be dealt with.

Good luck held, for when the Scottie was comfortably back in her ward the word came: "The waters have gone but I don't think she is full yet." I confirmed this but noticed that the pains that had been coming along as they should, had also gone, probably due to the fact that the obstetricians standby, bromide and chloral, had been exhibited a short while before and was now having some effect. No doubt in a very little while Nature would reassert herself and my assistance would be required.

I decided to stay in the hospital and as the hour was late (or early, depending on the point of view), i.e. 4 a.m., I would rest awhile. Accordingly I laid me down on a spare bed in the Queen Mary's wing and tried to have a snooze. I soon made a discovery that rather disturbed me as administrator of the comfort of the patients of the wing. The bed was quite the most unpleasant resting place that had been my misfortune to occupy since my war days. Turn and twist as I might, I could not find a position of ease. There seemed to be a solid bar of intensely hard material just where my great trochanter wanted to reside. To avoid this all-obtrusive bar (I don't usually go out of my way to avoid such things) I had but two courses open to me: (*a*) to slide down the bed when my feet stuck out at the end, or (*b*) to invaginate myself in an upwards direction when my head came out through the top rails.

I then came to the momentous conclusion that it was merely a question of mathematics. Six feet one and one half of human being will not fit six feet of patent bed, designed to accommodate a five foot six or seven individual. Too easy, wasn't it? (I have since made inquiries of other occupants of the bed, all are agreed that it is very comfortable. I must needs wait for confirmation of my own sensations until I get another O.S. or O.O.S. occupant.)

In spite of or perhaps because of my restless wanderings into the realms of higher mathematics, a knock at the door and a voice saying "Seven o'clock" surprised me as to the passage of time. I went to see my Mrs. X and found that though she had started to have some reasonably useful pains there was, in effect, "nothing doing." I waited for a couple of pains and it seemed that "nothing doing" was about right.

The belated hot bath and a little breakfast also appeared to fit the bill. Strangely enough the water was hot at that hour of eight in the morning.

A pleasant sense of relaxed tension was spreading over my body when the shrill sound of the telephone bell shattered the illusion that all was well with the world. Mrs. X had had several extra special pains, please could I come at once.

WHAT A NIGHT. ONE REALLY CAN NEVER TELL, CAN ONE?

I have not asked anybody's permission to publish these notes as I do not think that it would be right or proper to ask anyone to accept even secondhand responsibility for them. I can only say that the medical facts in as far as the record of the cases is concerned are true. My method of recording them is not the usual one (so cut and dried as to be, at times, rather boring) but an attempt to introduce a little more of the human element into the everyday happenings of our professional life.

REFERENCE.

ADAMS. "Acute Abdominal Disease."

———

THE GREAT SOUL.

By "UNST."

Captain X, Indian Medical Service, stationed at Ahmedabad, was worried. He said so in a long letter to me. He had not had leave, it appeared, for years and years and years, and it seemed likely that none would be granted to him for an equal period of time, due to his awful isolation and numerous responsibilities in Ahmedabad. As a very junior officer, he went on to explain, I could not understand the awful stultification, the moral and mental degradation, caused in moderately senior officers by prolonged lack of leave. I, on the other hand, was a very junior officer. I did not require leave, but I certainly needed experience and the broadening influence of travel. Ahmedabad was a delightful spot, if you were prepared to overlook the temperature, the moisture and one or two other inconveniences ignored by youngsters, but devastating to senior captains, short of leave. The club was a niçe club; there was shooting, etc., etc., etc. In short, would I come to Ahmedabad and relieve him what time he recuperated his faded energies in the United Kingdom?

At the time I was stationed in Colaba. I spent my time playing the usual games, hacking borrowed ponies on the perilous reclamation from Back Bay, and sailing a jollyboat which I shared with a civilian friend. The last pastime was an impassioned release from an otherwise artificial existence. The coast, with its hushed woods and deserted beaches, is enchanting. The waters in which we sailed were not always kind, and although my companion was an expert sailor we underwent more than one harrowing adventure. In such moments I consoled my lack of experience by doing exactly what I was told, and fervently reminding myself, at intervals, that I could at least swim. Somehow we emerged unscathed from adverse pranks of wind and weather, with a heightened zest for living, decently tempered with a feeling of thanksgiving to Providence. These experiences are pleasant in retrospect. Kind memory obliterates the phases of blue funk.

Over a drink in one of Bombay's palatial clubs, I informed my friend that the jollyboat partnership would be dissolved for a period of two months. I was going to Ahmedabad. He was philosophical about it.

"Oh, yes," he replied, to further inquiries, "I've been there. It's the worst place on the face of the earth. The cantonment's full of monkeys and brahminy bulls. Ghandi lives there too. There's one consolation. After going there, you can put up with anything. Have you read 'Condemned to Devil's Island'? Anyhow, you'll probably get killed in a riot."

I did not allow my youthful optimism to be downcast by this obviously exaggerated account, and duly entrained for the Station which had been so delightfully described to me. The journey was not without incident. My bearer, a temporary gentleman of dark hue, apparently had not carried out part of the duties delegated to him, namely, paying the coolies, who, defrauded and enraged, hung on to the train until the next station, where they requisitioned the services of a fluent babu, who explained the whole incident to me in flowery language. Hot and half awake, I distributed largesse, consigned him and his satellites to the devil, made a mental note to sack my bearer at the first reasonable opportunity, and attempted sleep.

I arrived at Ahmedabad station in stifling heat, collected my kit, and made off to the Mess. On the way I mentally compared notes with the despairing word picture drawn by my friend, and found his phantasmagoria to be, as I imagined, an exaggeration. What I could see of the city was filthy enough, in all conscience, but, as I bowled along towards the cantonment along broad roads, green and rolling country unfolded on either side, magnificent in trees and temples, stretching far to the horizon. It was my first sight of the Plains, and I shall never forget the impression of immensity, of size, of interminable distance, they leave on the traveller when he first sees them.

I arrived at the Mess after an interesting drive. The cantonment was handsome, green, and well furnished with stately trees and a wide, open, grassy maidan. One battalion of Indian infantry, and a company of British, garrisoned the place, and with them I made very good friends.

My opposite number, the leave-starved senior captain, was both relieved and exasperated to see me. Relieved, because he could now proceed on leave with an easy conscience, and exasperated, because, he stated, I had omitted to inform him of my arrival. For this reason there had been nobody to meet me at the station. I furiously denied this impeachment: I had written him a beautiful letter on a portable typewriter. Well, he never got it, but a drink in the Mess might solve the problem. We adjourned there, and before ordering refreshments he inspected his pigeon hole. There was the letter. He looked at it, and exploded. What the hell did I mean by addressing a letter like that? No wonder it had been held up. It was a miracle he ever got it at all. I scrutinized the envelope. It bore the inscription, briefly and legibly:—

"O.C.I.M.H. AHMEDABAD."

And nothing else.

At the time, I was impressed by the brevity and efficiency of official correspondence. On this occasion the latter quality seemed to have miscarried. Since then I have discovered that it very often does.

I took over the hospital. My Urdu, laboriously learnt in Colaba with the aid of a "munshi," was hardly up to standard, but it was sufficient to

deal with Indian troops, who were very understanding, and tactfully appointed a diminutive Sikh officer, affectionately known as the "shchool-marshter," to patch up the deficiencies.

I did not find my duties so onerous as I had been led to believe, and found sufficiency of leisure to try out the much-vaunted shooting, which had been held out as a bait by the captain, now jubilantly departed home. The only game bird in season at the time was the florican, or lesser bustard, which served, however, to make my first acquaintance with small game shooting in India.

One of the high lights of my stay in Ahmedabad was "mugger" shooting on the Sabarmati River. At the time I was in possession of a ·22 high-velocity Savage rifle I had purchased in a Borah arms shop in Bombay. This weapon had been laughed to scorn by everyone who saw it, but I must say it did me well in my first experience of big game. The accuracy of the sighting, the flat trajectory over a distance, and the extreme velocity, were all of advantage when shooting at a stationary mark, a prize which had to be struck within a handsbreadth area to be brought to bag. Later on I tried the same weapon against blackbuck and chinkara with bad (in one or two cases, alas, shocking) results, so I reverted to a larger bore rifle for that reason, and also because of the chapter on black-buck shooting in Colonel Stockley's fine book, which eschews small bore rifles for this particular form of sport.

When eventually I reached a station from which one could enter the great jungles I again produced my Savage, but was threatened almost with arrest by scandalized senior shikaris of repute, so I locked up the discredited American and subsisted on hired Mess rifles (double-barrelled and of terrific power, but rather rocky about the breech), a villainous old ·500 Express, and occasionally my faithful shotgun charged with "lethal." When I could enjoy the delights of hill shooting I received an unexpected and most welcome present of a ·356 Westley-Richards, and the Savage still remained locked up save for infrequent and long-range experiments on empty tins, chatties, and the like.

I still have the little rifle which shepherded my initiation to shikar, and occasionally, in that strange way inanimate objects have, it seems to reproach me for my desertion. I sometimes wonder, if I had had the courage of my convictions and defied public opinion, and even the writings of authorities, whether the Savage would not have proved itself a rifle fit for everything. It certainly let me down over those buck, but I "tailored" them, which one can do with any weapon.

At one point in our exploration of the reaches of the Sabarmati we found the river dried into a chain of pools of varying size, sparsely connected by narrow runnels. In one of these smaller pools we succeeded in capturing some baby "mugger," still with yolk-sacs attached. These,

wrapped in wet sacking and protesting vigorously, survived the journey to the club, where they disported awhile in the fountain. They soon tired of this new environment, however, and one fine day slipped off unseen. Perhaps, considering their dangerous character, their lives should have been forfeit, and I still have twinges of conscience when I think of one or all of them policing the shallows of some village ford.

The Sabarmati, tired of trickling, decided to flood, and one night came roaring bank high to the sea, in a great bore of water. Previous flood levels were not overtopped and existing precautions held good. Some dhobies were drowned near the city, but from all reports they died of their own accord. They had been washing clothes on a sandbank in the middle of the fallen stream. They were in a straight reach of the river and could see and hear the approaching flood when it appeared miles away as a dim blue line, even at that distance muttering and drumming with threatening sound and causing strange reversals in the air currents in the river bed. The dhobies stayed. Perhaps they were very busy. The flood came nearer. The muttering rose to a roar, the drumming to a rafale like heavy guns, and the little puffs and currents of wind to an ominous gale. The dhobies stayed. They were probably annoyed when the rising wind tore the clothes from their grasp, and may have experienced a dim apprehension of the sounding water, bank high and approaching with avalanche speed, but they stayed. The dhobies stayed and were drowned. To such extent can the fatalism of the East be carried.

A less tragic incident was occasioned by the temporary loss of the elephants attached to a travelling circus then performing in Ahmedabad. These elephants, five in number, were great favourites with the local garrison, and very partial to bottled beer. On this occasion they had been taken to the fallen river for their usual ablutions and, on the approach of the flood, their attendants had incontinently fled. The elephants, like the dhobies, stayed. One can imagine them eyeing the oncoming waters and thinking, with their glimmering intelligence, not quite up to dog standard, "Well, we're going to have a good wash for once." They got it.

The leader of the elephant washing party, however, was a man of some resource. He led his minions at breakneck speed to the railway bridge and from there, by some miraculous means, succeeded in rescuing all five of his charges. For this feat he received, I believe, the Kaisar-i-Hind medal. I am not sure of this, but he certainly deserved it.

There is an atmosphere in a club in a small military station in India which is bound to permeate a club in a small station. I am not casting, to quote the famous mis-statement, any asparagus, but those who read these lines will know what I mean. Such clubs need enlivenment, a breath of fresh air, something new, some rejuvenating influence.

The club in Ahmedabad got it. One evening the American gentleman arrived.

When I entered the club before dinner he was the fountain head of a large and well irrigated circle of newly acquired friends. He was "reminiscing."

"When I was in the South African war, the Colonel said to me, 'Here, you, you want to join the cavalry, do you? What do you know about horses?' So over I went to the nearest horse, grabbed its off fore, threw it and sat on it."

An awed silence. The horse must have been impressed. The American gentleman was a man of substance.

"I was sent out here by my firm to say Yes or No. That's what they paid me to say. If I say Yes I've got to make an estimate. If I say No, straight home I go; no estimate required. Hi, waiter."

Drinks were getting perilously low, and the night was warm.

"When I go to do a job anywhere I get in touch immediately with the head man. Then if you want anything and you've got his O.K., it's easy. Otherwise you're liable to lose time. Now, who's the head man here? Ghandi, of course."

The Most Exalted Civilian, who occupied a prominent and rather hypnotised part of the circle, tactfully murmured assent.

"Well, then, he's the man I want to see."

"There will be no difficulty about that," said the Most Exalted Civilian. "I'll fix it up and let you know," he added, rising to leave.

For the first time in the evening, the American gentleman seemed a bit put out. He had, I think, expected opposition: something he could grab by the off fore, like the horse, throw, and sit on. He shortly recovered, however, and radiated hospitality anew.

I soon found myself, with others, included in a dinner party to be held by him in his host's bungalow. His host, a padre, highly approved. He must have had a fairly monotonous existence, apart from such cyclonic interjections. During the course of the evening it was decided that the party to visit the Mahatma should consist of the American, the padre, a subaltern in the Indian infantry battalion then stationed in Ahmedabad, and myself. The evening terminated. Next day we all applied for, and received, official permission to visit Mahatma Ghandi.

Ghandi's 'Ashram,' or college, is on the north bank of the Sabarmati, and quite visible from parts of the cantonment. I was aware of its existence, and had heard, naturally, a great deal about the Great Soul himself, but I did not look forward to the ensuing visit with any feeling of excitement. I have never interested myself in politics, especially Indian politics. My feelings towards Ghandi are, and always have been, completely neutral. I have heard many things against him, but no man

ever enters the public eye without courting calumny. Ghandi's policy of simplification has been lauded as the perfect system of political salvation for India. It may be. I do not know. Ghandi himself, they say, is a Mahatma, a great soul. He may be, I do not know. If, when he dies, his name appears in the Calendar of Saints, I shall be as pleased as anybody else. On the other hand, if he fails to achieve sanctity, I shall remember him without rancour. As I have already stated, my feelings towards him are absolutely neutral.

It was a sweating hot day when the four of us crossed the Sabarmati to beard the Mahatma in his lair. On reaching the far bank of the river, we discovered that the route to the Ashram was not easily found. We had relied on a preliminary reconnaisance with field glasses from a few miles off. None of us had been there before, and none of us had brought a map. I explained to the subaltern at some length that this was his job, and did not hold forth much hope for him in his forthcoming promotion examination. He replied in adequate terms. Wandered among deserts, or, more literally, lost on a fairly good road on the bank of the Sabarmati. We stopped to interrogate a dhobi, who was battering the life out of some clothes, near a small stream. The dhobi, who seemed mentally on a par with the poor wretches who had perished in the flood, answered our numerous questions only by grinning widely and stabbing an ebony forefinger in the general direction of heaven. Somewhat exasperated, we set an experimental course nearly parallel to the river, and were soon rewarded by various signs of activity. On our right was a low, rambling collection of red-roofed buildings, the Ashram itself, as we discovered later. On our left, the ground, studded with huts and hovels of varying degree, fell away to the banks of the river. Straight in front of us, seemingly immobile, stood a large coloured gentleman, naked except for a loin cloth, bearing a number of cooking utensils on his head with a perfect sense of ease and balance.

We stopped. The American, vastly relieved, and sensing the end of his quest, leapt from the car with surprising agility, dispensing with the usual preliminary of opening doors, and approached the figure on the road.

"Ghandi lao," he demanded.

The Indian evinced less astonishment at this surprising outburst than was shown, rather impolitely, by the European members of the party, and replied in perfect English.

"You ask me to bring Mahatmaji. He is not here. He is praying. He will arrive presently. He will cross this very part of the road. Wait here and you will meet him."

"Having given us our instructions, he salaamed, no mean feat when your head is burdened with about a hundredweight of mixed pottery, and made to depart. The American, however, wasn't having any. He opened his mouth to utter, I am certain, the words, "Say, wait a minute,"

but, perhaps overawed by his surroundings, achieved only, "Could I speak to you?"

The Indian stopped, turned about, and waited politely for interrogation, which he received in plenty, displaying considerable calm under a rain of questions fired in the third degree manner. We gathered that he was a pupil in the Ashram, got up early, retired early, ate not much, fasted a lot, dug, spun and generally toiled. Very commendable. Again he took leave. Our American friend had been presented with a deal of information. He did not seem impressed.

"That guy's nuts," was his only comment.

He went on, inexhaustible in the heat, to tell us a long story which had something to do with chopping an immense quantity of wood in Minnesota, when the words froze on his lips, his eyes bulged, and his mouth fell agape. A bent figure, muttering in prayer with downcast eyes, was approaching along a path leading from the road to the Ashram. It was the Mahatma.

We were not alone to welcome him. As he came nearer the road, several Indians rushed forward to kneel at his feet and receive some form of benison. He approached, unseeing. It seemed as if he would barge blindly into the middle of us, as we stood there, moonstruck, in the road. The American stepped forward, his hand extended, and his lips wide with an unborn roar of welcome. He was forestalled. An Indian lady, magnificent in a richly embroidered sari, crippled but strikingly handsome, and a man, sound of limb, but certainly the reverse of handsome, materialized. They swooped on the Mahatma, took an arm each, and made to remove him from our contaminating presence. But the American would not be outdone. He followed the oddly assorted trio, and, without ceremony, grabbed the Mahatma by the arm.

"Look here, Mr. Ghandi," he ventured.

The Mahatma, his eyes still on the ground, interrupted him. He was obviously accustomed to such experiences.

"Come and have tea in my house," he said.

There was no welcome in his voice, neither was there repulsion. His speech was toneless, negative and flat, and remained so during the interview. In a daze, we were shepherded into a mud hut. There were no chairs, but one string bed. Ghandi, without further ado, sat on the floor, crossed his legs, produced a spinning-wheel and commenced to spin. The American sat on the bed, which protested loudly. The padre leant against the wall, looking rather like a dying duck. The subaltern stood in his usual manner, at ease, with his mouth open and a look of keen intelligence flashing from his eyes. I sat on the floor.

To start with, there were five of us. Soon there were nearer fifty. Hordes of Indian men, women and children crowded the door, swarmed

at the windows and crawled under the bed. I was terrified lest one urchin, who resembled a human bulldog, would bite the American in the calf and cause an international complication. We remained silent. Ghandi went on spinning. Several more human beings entered the room. Some flies came in as well.

The American, game to the last, attempted a diversion.

" Say, Mr. Ghandi," he said, " I've just been having a look at these mills, and I want your advice."

" I am sorry," the Mahatma answered politely, " I can give you none."

The American had suffered several mild " bouleversements " since stepping ashore on the Indian peninsula, but they must have been " bagatelles " compared to this. He gaped once or twice like a freshly-landed cod. His eyes bulged and he suffered a conversational collapse. There was a ripple in the throng of humanity blocking the open doorway, and a young Indian entered.

" My son," said the Mahatma, and introduced him formally.

There was another ripple and Miriam Slade entered, dressed Indian fashion in a sari of khadr cloth. She went straight to the opposite corner of the room, sat, and gazed on the Mahatma unwinkingly. Of us she took no notice at all. Nobody spoke. The entire situation, which would have been socially reprehensible at a pink tea party, seemed quite in order here. Even so, there was a certain amount of uneasy tension. The Great Soul solved the problem.

"And now," he said decisively, abandoning his wheel, " my son will show you round the Ashram."

Devidas Ghandi led us round the Ashram. We were shown people spinning, digging, planting seeds and performing various useful agricultural and textile work. One thing about the Ashram impressed me deeply. It is the only place where I have ever seen Indians of that type doing a real job of work and liking it. We were led eventually to a shop. The American expended fabulous sums on books. The padre bought nothing. I purchased a Ghandi cap and a prayer mat. I regretted this move, for the subaltern, having discovered I possessed some ready cash, promptly borrowed the balance and, with a strong burst of originality, purchased exactly similar articles.

There was nothing more to do than take our farewells to Devidas and motor back. We were sorry for the American, and yet admired him. His mission had failed, yet he was quite prepared to call it a day. He was delighted with his purchases.

" Some guys at home," he remarked, " will be sore when I show them these books."

We drove to the club to partake of very welcome refreshment, which we all needed after an interesting but rather trying day. I returned to

my bungalow to find that my newly-acquired Ghandi cap had been impounded by my scandalized bearer (I had substituted a respectable old Mahomedan for the coolly swindling outcast) and condemned to the outer darkness, or, more literally, thrown into an incinerator. The prayer mat I had been allowed to keep. It adorned the bathroom. I bathed, changed into mess kit, and mentally calculated that I might have time for one short drink before dinner if I hurried. Ghulam Mahomed, my new bearer, knocked and entered. In his hand was a letter. I opened it.

Captain Y, Indian Medical Service, stationed at Baroda, was worried. He had not had leave, it appeared, for years and years and years, and it seemed likely that none would be granted to him for an equal period of time, due to his awful isolation and numerous responsibilities in Baroda. As a very junior officer, he went on to explain, I could not understand the awful stultification, the moral and mental degradation caused in moderately senior officers by prolonged lack of leave. I, on the other hand, was a very junior officer. I did not require leave, but I certainly needed experience and the broadening influence of travel. Baroda was a delightful spot if you were prepared to overlook the temperature, the moisture, and one or two other inconveniences ignored by youngsters, but devastating to senior captains short of leave. The club was a nice club. There was shooting, etc., etc., etc. In short, would I come to Baroda and relieve him while he recuperated his faded energies in the United Kingdom?

I went to the Mess. I was too late for a short drink, even for soup. I apologized and sat down, anticipating fish.

"What sort of a place," I asked the subaltern, "is Baroda?"

He was succinct.

"Bloodier than this, if possible," was the reply.

It turned out, however, to be quite a pleasant spot.

Editorial.

LONDON SCHOOL OF HYGIENE AND TROPICAL MEDICINE INCORPORATING THE ROSS INSTITUTE.

Report of the Work of the School for the Year 1937-38.

The Chairman of the Court of Governors, the Rt. Hon. Neville Chamberlain, Prime Minister, in a letter read at the Annual Meeting of the Court of Governors on November 10, 1938, pointed out the value of the work now being done at the School which not only contributes largely to preventive medicine, but is vital for the development of the Empire. The School and the Ross Institute train men for official work and for industries, prosecute researches bearing on the prevention of disease, and apply the results of research in the field.

The Dean, Professor W. W. Jameson, writes the report on the work of the School. The great majority of the students take either the Diploma in Public Health or the Diploma in Tropical Medicine and Hygiene. In 1937-38, out of 186 full-time students, 154 took one of these two courses.

The course for the Diploma in Public Health lasts nine months. Instruction in the School is supplemented by visits to numerous places of sanitary interest and by lectures from persons with special experience in certain subjects.

In the course for the Diploma in Tropical Medicine and Hygiene both the clinical and the preventive aspects of tropical medicine are dealt with so far as is possible. An important problem is the co-ordination of the teaching of the various departments. Malaria, for instance, is discussed in its clinical aspects by the lecturers on tropical medicine, it is also of concern to the pathologist; the protozoologist deals with the life cycle of the malaria parasite, and the entomologist with the mosquitoes by which it is transmitted.

The Board of Management have recently combined helminthology and protozoology in one department under Professor Leiper. The classes in tropical medicine and hygiene are attended by students from many countries.

An important course provided by the School is for the Diploma in Bacteriology of the University of London. Altogether 119 graduates in medicine or science have followed this course since 1924.

In 1938 there was an intensive course given jointly by the Sections of Industrial Physiology and Medical Industrial Psychology. The course

was attended by factory inspectors and representatives of various industries. Firms in Bristol, Hull, Birmingham and St. Helens enabled members of their staffs to attend. The course will be repeated in 1939.

Two courses were held for non-medical men and women living in or proceeding to the tropics. The course in December was on general tropical hygiene: the course in June was on the control of malaria, organized by the Ross Institute mainly for planters and mining engineers. At this there was the record attendance of 186. The course is doing valuable work in spreading among laymen the knowledge of malaria control.

Many important researches are being carried out under the direction of the various Professors.

Professors Topley and Greenwood's long range study of experimental epidemics has been continued and an endeavour is being made to determine the effect of variation in the closeness and duration of contact in the spread of mouse typhoid in populations of mice. Studies have also been made on the effect of diet on the fertility, survival and growth of mice and on their resistance to infection. It has been found that a diet containing a small proportion of animal protein, when compared with a diet containing only vegetable protein, not only makes individual mice more resistant to infection by *B. typhi-murium*, but significantly reduces the mortality in herds in which the disease is spreading by natural contact.

Professor Topley, with Dr. Robinson of Oxford, has made further purifications of fractions from the typhoid bacillus and from *B. typhi-murium*; arrangements have been made for field trials of the immunizing potency of the former fraction. A trial was made in Hungary by Professor Tomosik, of Budapest; the results were satisfactory, but the incidence of typhoid in the districts was too low to allow of a definite conclusion. During the experimental work it was noticed that intradermal injection of minute amounts of the purified typhoid antigen gave a characteristic skin reaction. As it seemed possible that this reaction might be of use for diagnosis and perhaps as a control of effective immunization, it has been arranged to study the problem more fully.

Dr. J. C. Cruickshank, in collaboration with Dr. G. G. Freeman, has obtained a fraction from *H. pertussis*, which is a better immunizing agent. Mice immunized with it were found to be protected not only against intraperitoneal injection of *H. pertussis*, but also against infection by the intranasal route.

On behalf of the Ministry of Health an investigation is being carried out on the efficiency of methods for washing and sterilizing milk bottles, and attention has been directed to devising a standard bacteriological method of examining bottles.

In the Department of Entomology work is being undertaken on the

behaviour of *Anopheles minimus*, a mosquito important in the transmission of malaria, particularly in Assam.

Dr. Murray has continued his investigations on the spread of films of mineral oil upon water and their action in killing larvæ of mosquitoes. Working on culex larvæ and to a less extent on those of anopheles, Murray found that any oil which entered the tracheal tubes caused the death of the larva and that any oil which spread wide over water would penetrate the larva. He observed that mixtures of mineral oils frequently spread well over water, but then broke into masses of oil, separated by what appeared to be clear water. In his further work he found that on a clean surface the spread of oil continued until it reached what is known as its limiting thinness; but in a contaminated water there was a definite resistance to the spread of oil and the oil ceased to spread when the resisting force became equal to the oil's spreading pressure. Murray found that the spreading pressure of mineral oils is much increased by exposure to light. It is possible to extract the spread-giving substances by dissolving them in methyl alcohol and it might be possible to transfer these substances to an oil which is otherwise unsuitable for use in the field. It is generally known that an oil to which cresol has been added will spread over a wide surface, but the spreading is only temporary for the cresol will dissolve in water underneath and the oil film will then contract. The spreading presence of an oil can be greatly increased by adding to it certain petroleum sulphonic acids or the material known as "cracked spirit gum." Oils to which this has been added spread very widely and make a good permanent film, at least under laboratory conditions.

Work has proceeded on the differentiation of the species of mosquitoes related to *A. funestus* which until recently were thought to be a single uniform species. This work is of importance for the practical control of malaria in Africa as these species have been shown to differ from one another not only in points of anatomy, but as regards the water in which they choose to breed and in their relation to the transmission of malaria.

In last year's report mention was made of experiments which had been carried out by Dr. Crowden and Mr. Angus on an air-conditioned cubicle, which by its size and construction, comprising walls and ceilings insulated against heat by reinforced aluminium foil, required a less powerful air-conditioning unit to produce comfortable conditions than would be needed in an ordinary room in a tropical bungalow. Messrs. Newcon Industries have made an experimental cubicle which can be assembled by two men in less than an hour. The results of the tests on the commercially produced cubicle have been better than those obtained with the experimental model.

Investigations on the natural ventilation of dwellings have been continued by Dr. Bedford and Mr. Warner. Observations which have been

made in worker's flats indicate that in closed flueless rooms the amount of natural ventilation is very small and insufficient to maintain a fresh atmosphere. A flue, even without a fire at its base, is a valuable aid to ventilation, especially when it is the size usually provided for an open fire. This finding supports the view that, wherever possible, living rooms and bedrooms should be provided with flues.

During the last winter Professor W. W. Jameson was able to visit medical schools for Africans in Lagos, Khartoum and Mulago. He considers that the training of African medical personnel is the most important task before the medical services of the African colonies and the Sudan. The staffing of these huge countries with adequate numbers of European medical officers is quite impossible. It is in the best interests of the African people that Europeans should act as medical inspectors and specialists with trained Africans to undertake ordinary clinical duties in hospitals and elsewhere.

Clinical and other Notes.

ON SERUM REACTIONS.

By Major F. J. O'MEARA,
Royal Army Medical Corps.

THIS record of the reactions seen in my patients consequent on the therapeutic use of sera is the result of reflection after reading Dr. J. A. Ryle's book "The Natural History of Disease."

The quality of the serum used falls into two periods, easily divided. Serum used in:—

(*a*) England, Egypt and the Near East during the period 1923-1933.

(*b*) India during the period 1934-1938.

In the first period two of my patients developed anaphylaxis; serum sickness was not a common sequel. In the second period one developed anaphylaxis and very few patients have escaped a delayed serum reaction. I have not seen a death that could be attributed as directly due to serum administration.

The quantity of serum injected varied from 1 cubic centimetre to 380 cubic centimetres. The larger quantities have usually been given in the treatment of bacillary dysentery. The total quantity of serum given in doses of 100 cubic centimetres, usually intramuscular, being spaced over two or three days. In the delayed serum reactions seen in India, the intensity of the serum sickness was increased on each succeeding day after the incubation period. That is each succeeding injection produced its own reaction after the same incubation delay. The result was that the patient appeared to have a further attack of serum sickness on two or three succeeding days.

As a good deal of confusion exists as to the type of serum reactions that develop the tabulated list that follows is the division that I would make as a result of my personal experience. Other types of reaction outside that limited experience, must of course occur.

REACTIONS.

A. *Immediate.*—(One half to twelve hours after injection): (1) Anaphylaxis. (2) Protein shock (consequent on intravenous administration of serum). (3) Cardiovascular distress, generalized urticaria and urticaria gigantea of the eyelids and lips. (4) Local œdema at the site of injection (this œdema may be extreme); delay of twenty-four hours. (5) Local erythema and œdema around the site of the injection with lymphadenitis

of the glands draining the area. (6) Irritation of the meninges consequent on intrathecal injection of serum. (7) A case combining the following features: (*a*) Anaphylaxis; (*b*) protein shock; (*c*) hæmatoporphyrinuria.

B. *Delayed.*—(Six to fourteen days; average eight to ten days): (1) Serum sickness in its various grades with cutaneous rashes: (*a*) Consequent on a single small prophylactic injection; (*b*) recurrent attacks of sickness consequent on repeated injections of serum over a short period. (2) Malaise, adenitis. (3) Malaise, hydrarthrosis. (4) Malaise, fever, itching, sense of constriction of the throat, urticaria and great swelling of the eyelids and lips. (5) Fever, arthralgia, generalized lymphadenitis; spleen palpable in two cases.

The collective symptoms and signs of serum sickness are malaise, pruritus, vomiting, fever, skin rashes and œdema, abdominal pain, diarrhœa, arthralgia, adenitis and albuminuria. Any combination of these symptoms may exist, and so the clinical picture may vary to a considerable degree in case to case. For instance, the skin signs may be intense itching without a rash, erythema, discrete papular urticaria to confluent urticaria, the colour of the papules ranging from pink to an intense red, or urticaria gigantea.

A reaction encountered consequent on the intramuscular injection of 40 cubic centimetres of antistreptococcal serum merits detailed consideration as the benefit consequent on the injection caused great discomfort to the patient. The benefit that resulted was from an unforeseen upset in the balance of the body fluids. An officer was admitted to my care three days after he had received a sword wound above his left wrist joint. His left arm was septic and very swollen. An operation involving free incision of the forearm was considered necessary. Antistreptococcal serum 40 cubic centimetres was given into the right vastus lateralis muscle. Half an hour later his right thigh commenced to swell and by next morning he was unable to move in bed. His right thigh was then swollen to three times the circumference of the left, and there was an effusion into his right knee-joint. The œdema of his left hand and forearm had completely disappeared. The septic sword cut remained unchanged and healed slowly. The effusion into the thigh muscles took about a week to subside. The effusion into the right knee took two weeks to absorb.

An analysis of the clinical syndromes detailed suggests that the following systems may be involved in serum reactions: (1) Cardio-vascular; (2) respiratory; (3) cutaneous; (4); alimentary; (5), lymphatic; (6) articular; (7) reticulo-endothelial.

The symptom of involvement of the cardio-vascular system that causes most discomfort to the patient is because he is aware that his heart action is embarrassed. The clinical signs vary from being unable to distinguish the pulse beat at the wrist, to the more usual rapid pulse

rate of over 100 beats per minute; in both instances there is a fall in blood-pressure.

The involvement of the respiratory system may be mechanical if œdema of the soft palate or larynx develops. The patients had a sense of constriction of the throat that had caused them great alarm. The shallow breathing and pale colour in cases of anaphylaxis is accepted as a sign of shock.

The cutaneous signs are considered to be due to damage to the walls of the capillary vessels in the skin permitting transudation of serum; this corresponds to the response seen after an injection of histamine into the skin.

Abdominal pain, vomiting or diarrhœa indicates that the alimentary canal has been upset in its normal functioning.

The disturbance in the lymphatic system is more complicated. When œdema occurs as an immediate response after the injection of serum, especially when the injection has been made into muscle tissue, it is probable that the lymph spaces and smaller lymphatic vessels are involved with the capillary blood-vessels in the transudation of fluid that takes place into the tissue spaces. In the delayed reaction the main response is seen in the lymph glands.

Arthralgia is fairly common in serum sickness. Effusion has several times taken place into the knee-joint in association with large injections of serum into the vastus lateralis muscle on the same side. In serum sickness the following joints have been involved, with or without effusion, in the following order of frequency, knee-joint, temporo-mandibular, shoulder and ankle.

On two occasions serum sickness, after the usual delay of a week, took the following form. There was no rash in either case. There was malaise, fever, general enlargement of the lymph glands all over the body and the spleen became palpable. Enlargement of the liver was not detected. These two cases are submitted as evidence of irritation of the reticulo-endothelial system.

As to prophylaxis against serum sickness, calcium lactate had been given as a routine after serum injections. It does not appear to prevent the reaction developing. Expense has prevented the use of proprietary calcium preparations. If conditions permitted "Tabloid" calcium gluconate with calciferol (Burroughs Wellcome and Co.), or salpern (Boots), are worth trial as I am satisfied that they may be absorbed from the alimentary canal in the cramps associated with pregnancy.

Liquor adrenalinæ hydrochloridi by subcutaneous injection gives great relief to the subjective symptom of embarrassed cardiac action. The adrenalin usually requires to be repeated in small doses, as advised by Sir Arthur Hurst in the treatment of asthma, to obtain anything more than

temporary relief. I have on two occasions seen extensive urticaria completely clear up in less than a quarter of an hour after an injection of adrenalin. This is, however, an exceptional response to treatment. Calcium is of value during the attack. It has to be given by intramuscular injection as either calcium chloride 1 grain in distilled water 100 minims, or calcium-levulin (Glaxo), 10 cubic centimetres, or colloidal calcium with ostolin (Glaxo), 1 cubic centimetre. As to a local application for the irritation in the skin, lotio acidi carbolici (1-40) or calamine lotion made up with 1 per cent carbolic acid is used. So far I have not encountered toxic signs as a result of carbolic acid so employed.

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SHORT WAVE THERAPY.

By the STAFF OF THE MASSAGE AND ELECTRO-THERAPY DEPARTMENT, Royal Victoria Hospital, Netley.

(*Continued from p.* 52).

Therapeutical Considerations.

At this early stage a clearly defined field for short wave therapy cannot be expected. Every user is, in effect, doing research work. As more cases are treated by the individual and as additional knowledge from other sources becomes available, consolidation of results will enable empirical evidence to be discarded to an increasing degree and will set limits to the scope of this therapy.

Treatment with short wave therapy was introduced into the Royal Victoria Hospital, Netley, in May, 1938. It is perhaps as well to point out that there was no false enthusiasm; the apparatus had to justify its use on its merits, i.e., the ability to deal with conditions which did not react favourably to other forms of treatment. The medical personnel were, on the whole, definitely sceptical.

At the outset dramatic responses to treatment were obtained in some cases and this stimulated interest to such an extent that in a short time almost 50 per cent of cases sent for treatment by physical means were being treated with short wave therapy.

All writers on this subject are agreed that short wave therapy can be applied in acute inflammatory conditions, either specific or non-specific. This is possibly the greatest boon conferred by this form of treatment as rapid subsidence of inflammatory changes which follows does not

permit the formation of chronic sequelæ and thus comparatively rapid restoration of function occurs in many cases.

In order that the reader may compare the indications as suggested by textbooks with the practical findings at this hospital, the following scheme gives firstly the theoretical indications and secondly the results achieved.

Localized Suppurating Inflammation, e.g. carbuncles, boils, abscesses, whitlows.

Indications.—Specially indicated and results are almost invariably good. It should be noted that only minimal heat should be given and that other treatment should not be given in addition.

Royal Victoria Hospital.—Seventeen cases treated. All cured with one exception in an average of five treatments. The one case which did not respond received additional treatment in the form of fomentations.

Example.—Gunner K. Carbuncles on neck. Onset five days prior to short wave therapy treatment. Neck very swollen, tense and painful. One large carbuncle on the left side and a smaller one on the right side of the neck. The patient stated that the pain was relieved during the first treatment and on palpation the tension was decidedly less. On the second day, after a further treatment, a small incision was made in each carbuncle and the contents completely evacuated. After the fourth treatment the patient was discharged to duty.

Bone Diseases, e.g. osteomyelitis.

Indications.—In perfectly fresh cases which show no changes by X-rays a complete remission of symptoms may be anticipated. In cases of longer standing, demarcation and sequestration are favoured.

Royal Victoria Hospital.—Two cases of osteomyelitis have been treated, one of which was cured and one considerably improved, requiring fourteen and twenty-one treatments respectively.

Example.—Mrs. B. Osteomyelitis of the right ilium. Eighteen months since onset with a persistently discharging wound. The patient did not complain of pain. The wound healed after eleven treatments given over a period of three weeks and the patient was discharged cured after the fourteenth treatment.

Long-standing Low-grade Infections.

Indications.—These conditions frequently respond to short-wave therapy when not affected by all other forms of treatment.

Royal Victoria Hospital.—Four specially selected cases (three empyema thoracis and one lung abscess) were sent for short wave treatment in view of the long period in hospital with no appreciable improvement in each case. All cases were cured in an average of fifteen treatments.

Example.—Private W. Empyema on the right side. A staphylococcal

infection was diagnosed on May 14, 1937. Rib resection performed on May 26, thoracoplasty in February, 1938. At the commencement of short-wave therapy treatment on May 2, there was a large, freely discharging wound and the patient complained of an almost continuous dull ache in the back of the thorax. The man appeared toxic and seemed disinterested in the idea of treatment. At first the discharge increased in amount and was much thicker but after the third treatment the discharge decreased and became serous. The patient stated that he felt relief from pain after the second treatment. This patient had twenty-six treatments in all over a period of five weeks during which time there was a marked improvement in his general condition and outlook and the condition had cleared up.

(It is worthy of note that in this type of case there is increased discharge of a thicker nature from wounds after the first one or two treatments, but that thereafter the discharge decreases rapidly in amount and becomes serous.)

Fibrositis.

Indications.—In acute muscular fibrositis and perineuritis short wave therapy may cause a temporary exacerbation at first and should then be discontinued until the reaction has ceased. All writers stress that a weak energy (low filament voltage) output is essential for successful results when nerves are involved and this applies in chronic as well as acute cases.

Royal Victoria Hospital.—Several cases of muscular fibrositis, sciatica and brachial neuritis, and one case of panniculitis have been treated. Most cases have been cured and, with one exception, the remainder improved. One case of brachial neuritis completely failed to respond to this form of treatment even though the method of application was varied in every possible way.

Example.—Private P. Sciatica and lumbago. This patient was bed-ridden for months and suffered from continual pain and insomnia. Acupuncture and other forms of treatment were tried during this period without success. The patient improved rapidly after the first treatment by short wave therapy, was allowed up for increasing daily periods after the third treatment, and after the fifteenth treatment was practically free from pain and sleeping well. After forty treatments given over a period of nine weeks the patient appeared fit and could carry out strenuous remedial exercises.

Joint Diseases and Injuries.

Indications.—Short wave therapy can be tried in all forms of arthritis, both specific and non-specific. In gonococcal arthritis it is the treatment of choice and good results are almost certain.

Royal Victoria Hospital.—Several cases have been treated, including

osteo-arthritis, gonococcal arthritis, traumatic arthritis and post-operative menisectomy. All cases have shown marked improvement in mobility; pain has been relieved and active inflammation has subsided.

Example.—Pte. G. Gonococcal arthritis of the right knee. Onset in February, 1938, four months previous to short wave therapy treatment. History of persistent swelling, pain and some limitation of movement. The patient had a pronounced limp. After the first treatment the swelling subsided and pain was relieved. After the fourth treatment full mobility was restored and the patient could run up and down stairs without difficulty. After nine treatments the patient was discharged to duty.

Skin Affections.

Indications.—Any type can be treated but evidence is lacking regarding any specific indications. Literature on the subject would suggest that good results may be anticipated in dermatitis and acne vulgaris.

Royal Victoria Hospital.—Several cases have been treated, including a long-standing dermatitis, impetigo, acne vulgaris and psoriasis. It has been difficult to form an estimate of comparative merit in these cases as for a long time most skin diseases have been treated very successfully with ultra-violet radiation. The most that can be claimed for short wave therapy in this respect is that the skin conditions treated have shown improvement.

Chest Affections.

Indications.—Schliephake, who has done considerable work in this field, claims good results in most chest and lung conditions and has treated tuberculosis, pneumonia, empyema thoracis, etc., with considerable success. He points out that it is quite safe to give heavy doses through the thorax because the comparative lack of tissue and very good blood supply result in minimal heating.

Royal Victoria Hospital.—Three cases of asthma have been treated but without success. In each case the symptoms were aggravated and short wave therapy treatment was terminated. One case of bronchiectasis in an elderly man showed considerable improvement after eight treatments.

Catarrhs of Upper Air Passages and the Common Cold.

Indications.—It is usual to effect a rapid and complete cure in such conditions as laryngitis, tonsillitis, the numerous catarrhal conditions of the upper air passages, and the common cold, if treated at the onset.

Royal Victoria Hospital.—Many of these cases have received short wave treatment and success has been so uniform that it would be invidious to single out an example. It has been seldom necessary to give more than two treatments on consecutive days and the patients state in many cases that they feel relief *during* the initial treatment.

Lack of space forbids further mention of comparative results but there are indications for the use of short wave therapy in the following conditions :—

(1) Diseases of the heart and vessels.

(2) Diseases of the gastro-intestinal tract, the liver and bile ducts.

(3) Diseases of the kidneys and urinary tract.

(4) Diseases of the glands of internal secretion.

(5) Diseases of the nervous system, e.g. motor and sensory lesions, inflammation of the brain and meninges.

It is hoped that sufficient data have been given by way of comparison to recommend a trial of short wave therapy.

Technique.

All makers of short wave apparatus supply pamphlets showing diagrams of apparatus, the points to observe in giving treatments, and are prepared to have an expert demonstrate the apparatus at the time of installation. Nevertheless, the novice with this form of treatment will find it a question of trial and error to some extent before obtaining the best possible results. If the following hints are observed, the possibility of overdosing will be done away with and good results should attend application from the beginning :—

(1) Always use maximum skin-electrode distance compatible with the area treated.

(2) Ensure that the patient being treated is in resonance. Increase or decrease energy by adjusting the filament voltage and always retune after such adjustment.

(3) Where the area being treated perspires, cover the surface with a thin layer of gauze.

(4) Do not have any metal in the field, i.e. buttons, pins, suspender buckles, etc. (Fillings in teeth can be ignored under ordinary circumstances.)

(5) Bandages and clothes need not be removed for treatment except in so far as (4) applies.

(6) Make the patient comfortable before tuning, moving subsequently upsets resonance by altering capacity.

(7) As a general rule do not aim at obtaining a heating effect. A barely perceptible warmth is the ideal. In stubborn cases warmth may prove of benefit.

Conclusions.

In so far as five months of experience will permit conclusions to be drawn, we appear to have in short wave therapy a means of treating successfully certain cases which are resistant to other forms of treatment. In conditions of a less serious nature, which yet result in marked dys-

function and trouble to the victim, such as carbuncles, boils, etc., rapid and often dramatic cure is the rule rather than the exception.

Short wave therapy is not by any means a "cure-all." At a later date it is probable that (as in the case of ultra-violet radiation) conditions will be grouped in which short wave therapy will be regarded as (*a*) specific; (*b*) a valuable adjunct, but of secondary importance to some other form of treatment; (*c*) in which it may or may not be of use. Until such a grouping is achieved, the user would be well advised to be guided by an up-to-date textbook or books, and by increasing experience in the differing conditions treated.

It has been stated under Technique that a general rule is to give an energy output such that minimal heating is felt by the patient. There are, however, certain cases where a heavy energy output appears to be indicated and is justified by results. Such cases as chronic lumbago and sciatica, low back pain and long-standing arthritis are instances where this form of attack often produces the best results.

It is worth noting that there is practically no risk of a burn with this form of treatment.

Finally, there does not appear to be reasonable room for doubt that in short wave therapy we have the greatest single advance in the electro-therapeutic field of modern times, and a means which will prove of increasing value in combating disease and injury.

The staff of the Massage and Electro-Therapy Department are indebted to Lieut-Colonel S. J. Barry, R.A.M.C. (late Officer Commanding the Royal Victoria Hospital, Netley), for permission to send these cases for publication.

Echoes of the Past.

FAMOUS MEN—SIR ISAAC BROCK.[1]

By F. J. WOODWARD.

MAJOR-GENERAL SIR ISAAC BROCK, K.C.B., Lieutenant-Governor of Upper Canada, regarded as a national hero of that great country, was, perhaps, one of Guernsey's most illustrious sons.

Born in 1769, the year of birth of those great giants of destiny, Napoleon and the Duke of Wellington, he was a direct descendant of Sir Hugh Brock and came of a fighting stock, saturated with stories of his ancestors and possessed of a remarkably adventurous spirit. At the age of 10 he swam a mile between Castle Cornet and the mainland, across

[1] This article is reprinted by kind permission of *Good Motoring*.

uncertain and dangerous currents, with no other inducement than the joy of achievement.

Self-contained, restless, resolute and fearless as a boy, he carried these qualities to his grave and added in manhood a strength of body and loftiness of soul that inspired confidence and endeared him to all his brother officers and men.

In his early years he found athletics more attractive than learning; but on becoming an ensign at 16 he bent himself to his task and neither banter nor his love of sport could break his resolve to succeed.

At 21 he was gazetted Lieutenant of the 49th (the Royal Berkshires)—a fair-haired, blue-eyed giant of 6 feet 2 inches with limbs like a gladiator—and went to Barbados. The beauties of Barbados attracted him, but garrison duty did not and he returned later to England to train recruits.

At 26 he was a major, a soldier to his finger-tips, and at 29 he was promoted to Senior Lieutenant-Colonel of his regiment—rapid promotion, even in those days when commissions and advancement could be purchased.

His position was no sinecure. The regiment had become thoroughly demoralized under the lax discipline of the former C.O. and he resolved to put things straight. How well he succeeded may be seen from the words of the Commander-in-Chief: ". . . Out of one of the worst regiments in the service Colonel Brock has made the 49th one of the best." High praise from the Commander-in-Chief to a Lieutenant-Colonel.

War was then stalking Europe and England was drawn in to oppose Napoleon. Brock and the 49th saw active service under General Moore (Sir John Moore of Corunna fame) at Egmont. It was characteristic of Brock to be off at the bugle call like a sprinter at the crack of the pistol. He would lead: others might follow. In the charge he was wounded, stunned, dismounted and his holsters shot through, but still he continued to command. Nothing daunted him. Nothing could stop him.

Later he was with Nelson in the battle of Copenhagen, ready to lead the storming party. But the heroic defence of the Danes made this impracticable and he was compelled to remain aboard and see his men mown down by grapeshot.

Soon after that we find him with the 49th on his way to Canada, from where, except for a few months leave, he never returned. It was a change destined to bring him fame and to write his name in the scroll of that great country's heroes.

The change was not to his liking. Military opportunity beckoned him to the Peninsula, while the prospect of advancement in Canada seemed hopeless. But once on board his buoyant optimism and faith flung disappointment and misgiving to the winds and the sea awoke in him that Viking spirit inherited from his ancestors. His was a spirit that could not long be suppressed.

At Quebec he found that harsh treatment had brought a crop of mutinies and desertions. A court-martial consisting of a captain and two subalterns in those days could impose 999 lashes with the "cat" steeped in brine. The soul of Brock rebelled against such cruelty.

On assuming command at Fort George he substituted kindness for cruelty and extended privileges for restrictions. To a hesitant soldier who, he knew, was about to desert, he said, bringing his clenched fist down on the table, "Don't lie. Tell the truth like a man. You know I have ever treated you kindly. Go and tell your deluded comrades all that has passed and also that I will still treat every man with kindness. Then you may desert if you please."

During his three years of command he lost only one man by desertion. The troops respected him and in their loyalty would do anything for him.

He quickly set himself to win the confidence of the Indian and the big-hearted allegiance of the fur-traders. Stories of danger sent him exploring the interior, following the trails blazed by the tribesmen. He studied the packmen and canoeists and imitated their feats of strength on the rivers and great lakes. He was storing up knowledge and experience to be of service in his future career.

In 1805 he was gazetted full Colonel, and in the following year he succeeded to the command of Upper Canada as Brigadier.

Relations between Canada and America were becoming strained and Brock set himself to meet the impending danger. In 1807 the British Government were insisting upon a right of search, and the gunboat Leopard stopped the American frigate Chesapeake to search for deserters and, on being resisted, gave her a broadside. Napoleon, smarting under the defeat of Trafalgar, had declared universal blockade of foodstuffs going to Britain, and America aided and abetted him. Britain replied by not allowing ships to go to French ports till they had first called at a British port. Trouble was brewing and Brock warned the War Office of the inadequacy of his forces to defend nearly five hundred miles of frontier.

Meanwhile he was studying (in Montreal, Quebec, Fort Erie, York, Niagara, Detroit and elsewhere) military means of transport by road and water, always alert, always exploring and enquiring from settlers and travellers from Pennsylvania, New York, New Jersey, who came to Canada to seek fertile soil and freedom from taxation.

Still from time to time he was pressing for transfer to Europe and more active service, and it was not till he was promoted in 1811 to Major General and appointed (at the age of 42) Lieutenant-Governor of Upper Canada that he became reconciled to the life there and with set purpose assumed the duties of his high office.

Fate, however, decreed that he should not hold this office long and he met his death in the following year in the hour of victory, fighting to save Canada from the invasion of the Americans.

He had achieved fame and was for the time the man of the hour. The Duke of Kent (father of Queen Victoria) wished to meet the soldier whose despatches had stirred the War Office. The Duke of York, Commander-in-Chief, was ready to give him a brigade under Wellington. The Duke of Manchester, Governor of Jamaica, touring in Canada, begged him to accompany him with canoes and guides. But stern duty kept Brock at his post.

The population of Canada was then only 320,000 against America's 8,000,000. To defend the 450 miles of broken frontier Brock had only 1,450 British troops and a militia that was mainly on paper. Stores were depleted, provisions costly, money nil, and the frontier needed heavier batteries. In his speech at the opening of the Legislature he used words that are echoing in the world to-day—" *While wishing for peace Canada must prepare for war.*"

Brock himself was indefatigable. He fought opposition furiously. He purged his troops of dissipated officers. He raised fresh companies of militia and sharp-shooters. Racing from one outpost to another he raised ramparts that looked imposing but had no substance—bluff forced upon him by lack of funds.

Then at last in June, 1812, America declared war on the pretence of Indian hostility. A fever of militarism spread throughout Canada and drill took the place of quadrille. While a supine Governor-General was advising retreat, Brock was thundering out his " No surrender." The country called for a saviour and Brock—vigilant, sagacious and brave to a fault—faced the crisis unflinchingly, though with inadequate forces. He knew that the price of defeat was the cession of Canada to France. " *Are you prepared to become the slaves of this despot Napoleon who rules Europe with a rod of iron?* " he cried, while urging his troops to repel the invader and let not their children reproach them.

He took Detroit with hardly a shot fired. What a different scene from modern warfare. Soldiers in scarlet, sailors in blue, Indians—half-naked savages in fresh war paint and feathers—shrieking coo-ees and war-whoops. Drums and fifes, and the resonant roll of the drums. Brock, in his brilliant uniform on his grey charger, flashing hither and thither in the sunlight. "*I will never ask them to go where I do not lead*" was his motto.

By the surrender of Detroit Brock secured 60,000 square miles of territory, 33 cannon, with stores and munitions worth £40,000. Guns boomed from St. James's Park and the Tower, and the bells were pealed when the news reached London. Brock was created K.C.B. It was his hour of triumph.

But before the insignia of his high honour reached Canada he had already given his life for the Empire.

Scarcely had the echoes of his victory died away when the Governor-General, by an unwise armistice, gave the enemy a chance of augmenting their forces and Brock was directed to vacate Detroit and the 60,000 miles of land. He declined to do so and prepared to meet the fresh attack on the Queenston Heights.

With inadequate forces he met the shock, galloping like a spectre in the gloom of early dawn from one post of danger to another. He took his last cup of coffee, mounted, from the hand of his betrothed and rode away into the fury of battle amidst bursting shells and flying grapeshot. The redan was captured by the enemy and he resolved to recover it. In the hour of victory he was stricken down when only 50 yards from his objective.

He had saved Canada, but he gave his life in doing so.

The fortunes of war fluctuated until peace was finally restored in 1814; but the courage, judgment, military skill and personal magnetism of Major-General Sir Isaac Brock were greatly missed, though his inspiration remained to urge the troops on to victory. "Revenge the General!" went up the cry from the 49th as they hurled themselves into the fury of the fight.

A cenotaph marks the spot where he fell and a monumental column commemorates his great services to Canada and the Empire. He had been a great man in every sense of the word.

Travel.

KENYA.

By Lieutenant-Colonel F. S. GILLESPIE,
Royal Army Medical Corps.

We had toyed for years with the idea of visiting Kenya, to see my brother Ivor and his wife. When in S. India we had gone as far as inquiring about fares but we never seemed to have the necessary cash. However, when we were transferred from Malta to Cairo in June, 1937, things seemed more hopeful, more particularly as Ivor had written to say he was in a good district, and I should come while he was there if it could possibly be managed. Kenya sounds so near Egypt that we had ideas of flying down. We soon changed our minds when we found that the single fare was £73. Eventually we arranged to go Tourist Class on the "Llandaff Castle" leaving Suez on December 11 and embarked at about 2 a.m. after driving down from Cairo in the afternoon. The voyage calls for little comment, we didn't expect much luxury travelling "Tourist"

but it was really quite comfortable, though very crowded; my cabin companions were pleasant, but Ivy, with whom tidiness is almost a disease, wasn't quite so lucky.

We called at Port Sudan and were disappointed at not seeing the submarine coral gardens, but it had rained heavily in the morning and the previous day and the sea was too muddy. We had close on twenty-four hours in port and it seemed to be chiefly spent in unloading whisky and gin and there were also a few cases of lime juice and a little machinery; but it certainly looked as if the inhabitants of the Sudan were going to have a cheery Christmas.

We had a look round Aden and had a lot of amusement bargaining for silk handkerchiefs and scarves which were very cheap if one waited till the time came for the sellers to leave the ship.

The run from Aden to Mombasa is a dull one and we were very glad to see the pretty harbour at Kilindini.

Ivor had been D.C. at Mombasa eighteen months before and oiled a lot of wheels for us, which made landing and customs formalities very easy. A friend of his, MacIntyre, took us off to the Club for lunch where we had excellent curry and prawns, and Mac and his wife accompanied us to the train at 4 p.m., where a huge crowd of scouts and guides had assembled to see Lord and Lady Baden Powell. The journey from Mombasa to Nairobi in an old 1st class coupé relegated for 2nd class use was most comfortable. Most people travel 2nd in Kenya and very good it is. Serving officers and their wives are granted half fares on production of a certificate signed by their C.O. to the effect that they are serving officers. A few spare copies came in useful for native clerks, who liked to have them in support of having issued a half-fare ticket.

We were up at daylight to view the game alongside the railway, unfortunately it was misty in the early morning and visibility was poor, but once it cleared we saw quantities of game, zebra, eland, kongoni, wildebeest, Grant's and Thomson's gazelle and ostrich. Ivy caused some amusement in the breakfast car by exclaiming "There is a kangaroo," it turned out to be an ostrich on closer inspection. At Nairobi we were met on December 22 by Ivor and a friend and soon got our kit stowed, collected a rifle he had borrowed for me, and bought some special H.V. ·275 Mauser ammunition for it. The 95 mile journey to Embu was first through prosperous looking coffee and sisal estates and then through native reserves with crops of maize and millet. Embu was a surprise to us. Ivor was so certain that we would be disappointed in Kenya as compared with India, that he said very little about it and we weren't at all prepared for the lovely garden and trees and the gorgeous view of Mount Kenya 50 to 60 miles away with its snow-clad peaks. The garden was Rita's pride and joy and certainly had a marvellous display of flowers and

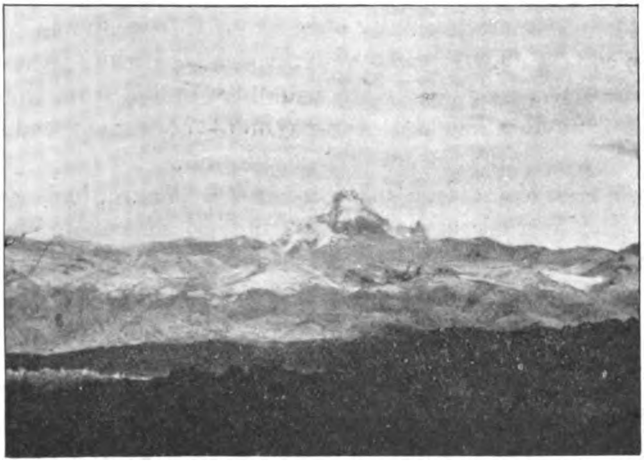
vegetables; a beautiful lawn with cypress and mango trees in front of the bungalow was always a joy to look at.

From now on I shall keep to extracts from my diary.

December 23: Went for a drive in the bush along a fairly good track and shot a lesser bustard. There was some rudeness over this, as Ivor had insisted on my taking out a 10s. bird shooting licence which expired on December 31 and the lesser bustard was the only bird I got on it.

Christmas was a cheery period with Walter and Edna Cox arriving for three days, a delightful pair of coffee planters.

December 26: First day's fishing on the Thiba 17 miles off, a river flowing from the slopes of Mount Kenya and well stocked with rainbows. I had three fish on the fly—best 1 pound 2 ounces.



Telephoto of Mount Kenya from north.

December 27: We fished the Thiba again. I got two fish just under 1 pound.

December 28: I had taken out a serving officer's fourteen day licence and went off in the bush in Ivor's car accompanied by a tracker N'Gari and a most useful fellow Jacobo, a rather superior mission-educated boy who spoke English and acted as general factotum, gun bearer and interpreter. My weapons were a D.B. Hammer ·450 cordite, a ·275 Mauser, both borrowed, and my 12 bore loaded with lethal bullets and faithfully carried by Ivy to stop her valued spouse being clawed by some charging beast. Fortunately this emergency never arose, but I feel certain she would have dealt with it most effectively if it had. N'Gari looked on me with contempt, I am afraid, as the game of which he made a speciality was buffalo, and all I wanted was lion and of course the chance of meeting lion was considerably less than the chance of buffalo. We saw a fair number of kongoni, impala and water buck, and on our way back about noon saw

two huge rhino about 100 yards from the track, standing by a water hole. I hadn't got a rhino on my licence and to tell the truth I wasn't very sorry, for they are colossal and to me rather awe-inspiring beasts. I am assured that they are easy to approach upwind and fairly easy to kill; however, they have an unpleasant habit of charging entirely unprovoked, so I kept the engine running while we watched them.

December 29: Went out about 5.30 a.m. and saw a fine herd of eland, beautiful beasts, also three buffalo which cleared off too quickly for us to get much of a view of anything except their east ends as they travelled west.

December 30: We stayed at home and wrote letters and I had a game of golf on the local golf course, constructed by Ivor with local labour; three browns, played from various tees, made up a very sporting little 9 hole course and as there were normally only seven Europeans in the station it didn't get too congested. A fourth brown was added while I was there which made it even better. Caddies were usually supplied from the local prison where they were detained for non-payment of taxes; caddying was a popular job, as they got paid 1d. each per round.

December 31: We started off early and by 7 a.m. had gone about 15 miles along a bush track and saw a large herd of buffalo on a hill at the far side of a valley, they must have been more than a mile off, but they very soon saw us and cleared off. A little further on Ivy suddenly spotted a head moving in the grass and pointed it out to me. I saw it was one of the cat tribe but wasn't quite sure what and drove up closer thinking it was a lion. As I got nearer, I spotted two beasts on an anthill which I took to be lions and drove closer till I got within 50 yards and saw they were leopards. One was sitting up with its back to me and collapsed at once when it got a ·450 soft nose behind the shoulder, the other pushed off through the long grass and I had a couple of unsuccessful shots with the ·450 at its head. It then very rashly got up on an ant heap about 120 yards off and I grabbed the ·275 and caught it in the middle of the chest, it lay on its side kicking for a couple of moments and then rolled down to the base. We went to the first one and found it dead and then approached the other cautiously and found it dead also. Both were beautifully conditioned young females, just under 7 feet. We had a messy job skinning them and drove back in triumph. On the way back Ivy spotted two beasts under a tree by rhino swamp (the water hole where we had seen the rhino), N'Gari swore they were lions, we followed them but they didn't give us a chance and I feel sure from their size and tracks that they were leopards.

January 1, 1938, was spent in treating the skins, cleaning off any remaining fat and rubbing in salt. We were lucky in getting the help of a man from the agricultural officer who was quite good at dealing with

skins. We had an interesting hour wandering round the market place watching the local natives who had come in with goods for sale, chiefly foodstuffs, pots and ornaments.

January 2: We went to the upper reaches of Thiba where it ran through forest. The fish were very plentiful and much easier to catch but smaller than lower down. I had ten and Ivy seven, her first really successful day, and she is now a completely converted fisherwoman.

January 3: In the morning went to where we had got the leopards and found they had been completely demolished by hyena and vultures. We saw a large herd of buffalo and two rhino, one about 80 yards off which was moving parallel to the car for a time; however, it cleared off, to our relief, as they are known to charge a car at times.

January 3: We struck off in a different direction in the evening on the suggestion of a local man, who assured us he had heard lion roaring and seen fresh tracks. He took us into some fearfully thick bush and lost his way and it was only after creeping along rhino tracks that we eventually got into some more open ground and found our way back to the road; there we discovered some lion tracks which had been made ten days before, after some rain. On the way home we saw some very likely looking ground on the other side of the road and made up our minds to visit it next day.

January 4: We got off at 5.30 a.m. and were at the place we had marked down before it was light enough to see properly. As soon as we could see we started into the bush. Lots of kongoni and impala, but they didn't interest us except as possible lion food. Suddenly I spotted a group of five beasts under some trees about 120 yards off on our left. We all stopped to look and the biggest beast, a fine maned lion, bounded off followed by two lionesses, the other two remained under the trees and appeared to take no notice of us. I had a rapid think "Shall I let the lioness go and chance getting a shot at a lion later?" However, the answer was "Don't be a fool, take the chance that's offered," so, as the distance was a bit far for the ·450 I took the ·275 and took as careful a shot as I could behind the shoulder. I heard the bullet strike and Ivy says she (the lioness, not Ivy) gave a roar and then moved off slowly through the trees with the other one which I think was a nearly fully grown youngster. I thereupon stopped and considered matters for a bit to give her a chance to halt and stiffen up a bit and after half an hour we moved on. I hadn't gone more than 250 yards when I saw a suspicious looking object under a tree a bit over 100 yards off and it took some careful scrutiny to decide that it was the head of the lioness. Fortunately she moved it so I climbed on a fallen branch to get a better view and put in a shot with the ·275. The result was an angry roar and she stood up on her hind legs and clawed at the tree. I gave her a couple more for luck, and she made no further move.

Ivy had been standing by me with the 12 bore ready to deal with a charge and complained later that lion shooting was rather a tame sport. She had made the same remark about the leopards.

After a few minutes wait we approached the tree and found it very hard to pick out the tawny skin against the grass. She was a beautifully conditioned beast 8 feet 1 inch between pegs and we wasted no time in skinning her and getting her "lucky bones," the rudimentary clavicles that all the cat tribe carry embedded in the pectoral muscles.

I kept a sharp look-out for the rest of the "pride," secretly hoping that father would come back to look for the missing lioness. I had only one on my licence, but one can always shoot in self-defence!

Ivy and the lioness.

There was great rejoicing in the Boma when we returned with our prize and we certainly had been amazingly fortunate. Ivor, who had been seventeen years in Kenya, had seen only two lions and never even got a shot at one. I hardly dared admit afterwards that I had shot a lion for I was immediately met with a disgusted cry of "Well, I have been fourteen years in the country and never seen a lion and you come and bag one in fourteen days."

January 5: Spent most of the day cleaning and salting lion skin. In the evening we went to a native holding 6 miles off where a rhino had been doing a lot of damage and the Game Warden had given orders for his destruction. This meant that I could shoot him without a licence. However, the rhino didn't show up, chiefly I think because the game scout, a disreputable looking scallywag called Shadracha with an incredibly torn and patched old Burberry, brought us up wind of him. When Ivor asked him if he always approached his game down wind he replied "If I know there is a rhino or a buffalo there I go in and fight with him, I don't bother about the wind." We felt a little ashamed of ourselves for being so cautious.

January 6: We fished the forest reach of Thiba and got about a dozen between us of about ½ pound each.

January 7: I had promised to get some meat for the servants and for the trackers and those who helped with skins, so went out and shot an impala and a kongoni. Unfortunately both were so very dead when the Mahomedan lorry driver got to them that he couldn't stretch his conscience sufficiently to regard them as lawful meat even though he did "hallal" the impala which had been dead about fifteen minutes when he arrived. When we got back to the Boma about noon, Shadracha, who had been left to get news of the rhino, sent in a messenger to demand our immediate presence, the rhino was asleep in some thick cover and he could see him from a tree. We set off without delay and were shown the tree from which the bloody deed was to be done and the plan was that I was to climb the tree, Ivor and Ivy were to push off to a safe distance and I was to massacre the sleeping rhino. I thought I was being a bit of a cad till I saw the cover which was thick grass and bushes about 6 feet high. Shadracha demonstrated where the rhino was, about 40 or 50 yards down the slope and climbed the tree to confirm it, when suddenly there was a scuffling noise in the bushes which Shadracha announced, in a rather agitated whisper, was the rhino who had got up from his siesta much earlier than he was expected to and was now down wind of us and quite close by. Ivy made a very hasty assisted passage up the tree closely followed by me; however, the rhino evidently thought the combined smell of three Europeans and two natives a bit too much, for he pushed off into thick bush and wasn't seen again. He left the farm shortly after and returned to the forest a few miles off where if he is wise he will remain in safety.

January 9: I had promised Kalongo the lorry driver that I would slay another beast so that he could get some meat, so we set off at 6.30 a.m. and soon saw a small bunch of kongoni near the road. I shot at one with ·275 and reloaded, and rather to my surprise saw what I took to be the same beast crossing the valley with two others. I fired a couple of shots at long range and eventually brought it down and despatched Kalongo, who is stout and short-sighted, in pursuit. Just as he got up to it the beast got up and ran off. I followed up and came on it again and put in another shot and brought it down. This time there was no doubt about a lawful "hallal" for Kalongo had a hand-to-hand struggle with the kongoni in which he had eventually to be helped out with another shot from the rifle. He then went off for the lorry, loaded it up and returned to the road. To my horror, just as we got to the road I found another kongoni as dead as mutton; the one I had first fired at had dropped stone dead and the one I had taken for it was an unwounded one, and I had shot one more than I was entitled to on my licence. However, my excuse and apology was accepted later by the Game Warden.

January 11: There had been heavy rain the previous day and more during the night, a most unfortunate business as we had to drive to Nairobi, taking my nephew and niece back to school. Ivor went out a couple of miles and prospected and announced that chains would be necessary and so we set off on our 95 mile run. My only previous experience of chains had been in India when, once they were fitted, one drove along in safety. However, the earth roads of Kenya were a very different problem and we skidded about all over the place, a most hair-raising business. We got on to hard roads eventually and reached Nairobi safely, returning the next day.

January 15: We went off in the afternoon to see a new suspension bridge over Tana river about 30 miles distant, which had recently been built to join up two districts. A fine job, but rather surprising when one came to it in the middle of the bush with only a forest track leading up to it. We improved the shining hour by a bit of small game shooting—four lesser bustard, ten francolin, two partridges. The francolin or quarie as they call them were a bit bigger than a grouse, a very sporting bird when beaten out of crops.

January 17: We started off on a week's tour round Mount Kenya. First stop Meru, a delightful spot with lovely views over forest, plains and hills. There we stayed two nights with McKeag the D.C. and had a morning's fishing with little success as the river was in flood. In the evening we played golf on a sporting nine hole course filled with natural features to increase its interest, a bit expensive for inaccurate players as I found to my cost.

January 19: We moved on round the base of Mount Kenya, first through thick forest and then over open plains studded with thorn trees; through Nanyuki and across wide open grasslands enclosed as pasture for cattle farms, to the base of the Aberdares, a fine range of hills running up to between 8,000 and 9,000 feet. We stayed with a friend of Ivor, Hopkins, a D.C., who has built himself a house in his spare time—on local leave—made practically all his own furniture and panelling and done a great deal of the building work himself with the assistance of native workmen and now has a delightful home at which he can spend his local leave and to which he will eventually retire. The garden and trees were amazing: oranges, plums, peaches, passion fruit, lemons and grapes all had only been planted, at the earliest, since December, 1933, and some were now big trees laden with fruit.

January 20: We fished the Amboni running through forest at the bottom of a steep valley. Flies interested them not at all, but I found a small fly spoon, weighted and fished slow and deep, was most successful and got a dozen about ½ a pound or a little over; Ivy got five, Ivor and Rita eight between them.

(To be continued).

Current Literature.

KRAMER, S. D., HOSKWITH, B., and GROSSMAM, L. H. **Detection of the Virus of Poliomyelitis in the Nose and Throat and Gastro-intestinal Tract of Human Beings and Monkeys.** (Laboratories of the Infantile Paralysis Commission of the Long Island College of Medicine and the Jewish Hospital, Brooklyn, New York.) *Journal of Experimental Medicine*, 69, No. 1, 49.

The authors reviewed the literature and attempted to tabulate the efforts of the various previous investigators to recover the virus from nasal secretions and from the intestinal contents of man and animals. They consider the criteria essential for positive diagnosis to be: (*a*) the production of typical disease with paralysis in the experimental animal, (*b*) typical histopathologic changes in the cord, (*c*) successful passage of the disease to a second monkey, which at autopsy will present the characteristic pathologic changes in the cord.

There were 535 individual attempts to recover the virus from the nasopharynx in the human disease; 64 positives were reported, but only 14 passages to second animals were mentioned. Of 144 attempts to recover the virus from patients' fæces or from intestinal contents post mortem, 51 positive takes were reported but only 4 were passed on to animals. In 23 attempts to detect the virus in the upper respiratory tract of monkeys, 11 positives were cited, but only in 3 instances were the strains passed to a second monkey. After feeding monkeys with large doses of the virus there were 13 positives, but only one passage was recorded, and in no instance was the virus recovered later than forty-eight hours after feeding.

These results were thought to be significant, so that Kramer *et al.* proceeded to make their own experiments. Five strains of virus were recovered from nasal washings and from fæces. Four strains were of human origin and the fifth was from a monkey killed at the height of the disease. Of the human strains, the first was isolated from the fæces of a child, 14 years old, seven days after the onset of illness; the second strain from nasal washings of a child, 6½ years old, five days after onset of illness. The third and fourth strains were from a child, 2½ years old, nine days after onset of illness, one strain from nasal washings and the other from fæces.

The virus was also recovered from the nasal washings of two patients

during convalescence. This finding is considered to support the belief that human poliomyelitis is spread by human contact.

The recovery of the virus from the gastro-intestinal tract almost as frequently as from the upper respiratory tract is thought not to invalidate the conception that the mode of entrance of the virus is by the upper respiratory tract.

If the virus is present in the throat the physiological passage of nasal and oral secretions into the gastro-intestinal tract by reflex swallowing would explain the presence of the virus there; moreover, the tract might act as a temporary reservoir for secretions from the upper respiratory tract, and so the virus might be present in a higher concentration than in a sample of nasal washings.

The recovery of the virus from the fæces seven and nine days after the onset of illness indicates that the virus can withstand the gastric acidity which under ordinary conditions keeps the gastric contents relatively free from bacteria. It also suggests that improper disposal of fæces from patients may have serious public health consequences.

KRAJIAN, A. A. **A Reliable Method of Staining** *Spirochæta pallida* **in Smears.** *Arch. Dermat. & Syph.* 1938, v. 38, 427-8, 1 fig.

Krajian claims for the method of staining *Sp. pallida* which is described here advantages over all other methods of staining and even over dark-ground illumination. The lesion is rubbed until it bleeds with a swab moistened in alcohol and left for several minutes for bleeding to stop, when a clear serous exudate appears. Smears of this are dried in air and flooded for five minutes with a warm solution (called No. 1) of uranium nitrate, 1 gramme; formic acid (85 per cent), 3 cubic centimetres; glycerine, 5 cubic centimetres; acetone, 10 cubic centimetres; and alcohol (95 per cent), 10 cubic centimetres, after which each is washed in distilled water and treated with weak mastic solution (three drops of gum mastic with 7 cubic centimetres of 95 per cent alcohol) for two minutes. The mastic is poured off and the surface is blown upon with the breath before the slide is rinsed in distilled water. It is then silvered twice by flooding with 1 per cent $AgNO_3$ and warming this till bubbles arise for three minutes each time. The silver is poured off, and a thin coat of developing solution applied (hydroquinone, 0·31 gramme; sodium sulphite, 0·06 gramme; neutral formaldehyde solution, 40 per cent, 2·5 cubic centimetres; pyridine, 2·5 cubic centimetres; saturated solution of gum mastic in 95 per cent alcohol, 2·5 cubic centimetres; distilled water, 15 cubic centimetres). The slide is left under the electric light for two minutes, being warmed slightly, and is then washed and dried. The No. 1 solution keeps indefinitely, mastic solution should be fresh, and the developing

solution keeps for two or three weeks. A photomicrograph illustrating a stained smear is shown; in it can be seen at least seventeen spirochætes with spirals very well defined. L. W. HARRISON.

Reprinted from "Bulletin of Hygiene," Vol. 14, *No.* 1.

KRAG, P. **Sensitiveness and Specificity of a Bordet-Wassermann Reaction (Mϕrch) and Kahn's Standard Reaction.** *Bull. Health Organization.* (League of Nations.) 1938, v. 7, 451-9.

This is a report on Mørch's method of the Wassermann test carried out in parallel with the Kahn test on 25,924 of the 26,028 blood specimens received at the State Serum Institute, Copenhagn, in the first quarter of 1937. The Mørch method, which is described in fair detail, is said to be very sensitive and reliable, and expresses strengths of reactions by numbers which range from 0, or negative, to more than 12. The strength of the Kahn reaction can also be expressed by numbers, and in this paper the Kahn strengths are translated to numbers on the Mørch scale; thus 10, 20, 40 and 60 Kahn units respectively are read as 3, 5, 7 and 8 Mørch units, and so on. If, for example, a given serum gave a Kahn reaction expressed as 10 on the Kahn scale (translated here to 3 on the Mørch scale) and a Mørch W.R. expressed as 5 Mørch units, it would be regarded in this comparison as having given a stronger reaction by the Mørch method than by the Kahn.

In the series of 26,028 sera were 5,239 from treated, latent and "cured" cases of syphilis, and of these 5,135 were tested by both the Mørch W.R. and the Kahn, 3,216 proving negative to both and 1,919 positive to one or both. In this group of 1,919 sera the Kahn gave 1,875 positive reactions and the Mørch W.R. 1,604, showing therefore a greater sensitiveness of the Kahn over the whole series. But the author says that this method of comparison is misleading; if the lower strengths (1 to 3) are excluded, the Wassermann proved the more sensitive. The author's table shows in the lower strengths 1,039 positive Kahn and 671 positive Mørch W.R., but in the higher ones 933 positive W.R. to 766 Kahn. The balance of the sera, 20,789, had not previously been tested; 799 were excluded for various reasons and 19,405 were negative by all methods. Of the remaining 585 sera, 107 were negative by both these methods but positive to one or other of the Müller, Meinicke or presumptive Kahn tests. In the remaining 378 were 201 with no history of syphilis, and in the balance of 177 cases the two methods under review gave much the same number of positive reactions, but the strength of the W.R. is stated to have been generally greater than that of the Kahn. In regard to specificity the author, after a rather elaborate calculation, concludes that

the Mørch W.R. has an advantage over the Kahn. The author's summary in the paragraphs below states a case for a revision of views hitherto held on the respective advantages of the Wassermann and flocculation tests and suggests that it would be advantageous to hold another laboratory conference.

"At the League of Nations' Laboratory Conferences—1928 in Copenhagen and 1930 in Montevideo—it was agreed that:—

> "'The best of the precipitation tests were demonstrated to be superior as regards sensitiveness and equal as regards specificity to the B.-W. reaction and its modifications.'

"The investigation of WR (Mørch's Bordet-Wassermann modification) and KR (Kahn's standard reaction) which has been described above, appears to show that we now have complement-fixation tests that are equal to the Kahn test in respect both of sensitiveness and of specificity though each of these two kinds of tests has certain advantages and certain defects.

"Other institutes having had the same experience, it would accordingly seem advisable when the opportunity arises at a new laboratory conference to compare the more recent modification of complement-fixation with the precipitation tests—those already examined as well as those which have appeared since."

[Without in any way disputing the above conclusion, it seems a little difficult to follow the evidence, which depends apparently on an arbitrary correlation between numbers expressing strengths of reaction by one method with those expressing strengths by another which depends on a different principle.] L. W. HARRISON.

Reprinted from "Bulletin of Hygiene," Vol. 14, No. 1.

LAUGHLEN, G. F. **The Laughlen Test for Syphilis.** *Canadian Pub. Health J.* 1938, v. 29, 396-400.

This is a further report on the Laughlen test [this *Bulletin* (Price) 1938, v. 13, 41] with a few details on technique and results by Laughlen and other authors.

In the test as originally described, Laughlen antigen activated with electrolyte according to directions supplied is mixed on a slide with neat serum, the slide is rocked, and the flocculation is observed in less than ten minutes by looking at the mixture towards a dark surface in a strong light.

On the question of inactivation or otherwise of the sera, he thinks that it should be carried out when practicable as a few specimens have been negative in the raw state but positive after inactivation. In a series of

1,834 fresh samples tested before and after inactivation, 1,777 were negative before and after and 45 were positive; in the remaining 12 there were differences, 4 being negative and 5 doubtful in the unheated state but positive after heating; one being doubtful heated but positive unheated; one more strongly positive heated and one less strongly so.

Various workers are quoted as having obtained a high percentage of agreement of the Laughlen test with the Wassermann and Kahn. Laughlen, in his first 2,000 tests, found 97 per cent agreement with the Wassermann and 98 per cent with the Kahn. With a later series of 3,000 specimens there was 99 per cent agreement with the Wassermann and 99·4 with the Kahn.

Results with citrated plasma are approximately the same as with serum, provided that care is taken not to dilute the plasma with citrate. The method recommended is to receive three to eight drops of blood into a small test tube which has first been filled with 5 per cent sodium citrate in normal saline and then emptied, leaving only the citrated saline adherent to the glass.

In testing spinal fluid the globulin should be concentrated by the technique employed in the Kahn test of spinal fluid.

L. W. HARRISON.

Reprinted from "Bulletin of Hygiene," Vol. 14, *No.* 1.

Reviews.

GIBRALTAR UNDER MOOR, SPANIARD AND BRITON. By the late Major-General E. R. Kenyon, C.B., C.M.G. 1938. Pp. xviii+136. London: Methuen and Co., Ltd. Price 8s. 6d. net.

Gibraltar was once described by a famous author as an arid protruberance bounded on three sides by water and on the fourth side by a race-course.

For those who wish to learn more about this famous rock and its great history, Major-General Kenyon has provided an interesting and comprehensive account, illustrated by well chosen and artistic photographs. The history of Gibraltar and its sieges is compressed into concise form. This most readable book amply fulfils the author's purpose of supplying the connecting links between existing names and past events.

The book owes a great deal of its charm to the enthusiasm of the author and his keen interest in detailing all the records, whether it be Moorish history or the doings of the Royal Calpe Hunt.

Those who are familiar with the scenes and history of the Rock will discover many new and interesting facts, and to them this book will be a valued possession. E. B. A.

A SHORT PRACTICE OF SURGERY. By Hamilton Bailey, F.R.C.S.Eng., and R. J. McNeill Love, M.S.Lond., F.R.C.S.Eng. 4th Edition. 1938. Pp. viii + 996. London: H. K. Lewis and Co., Ltd. Price 28s. net.

This book appeared first in 1932, a second edition being published in 1935. That there should have been either a reprint or a fresh edition every year since 1935, indicates popularity and life. It is a survey of general surgery, up to date. In their Preface the authors quote a Chinese proverb: "one picture is worth a million words." It is no mean effort to cram such a wealth of information into a book of such handy size, containing over 800 illustrations (55 new in this edition), 109 beautifully coloured. The authors and publishers (Lewis) are to be congratulated. The value of this book lies in the fact that it is essentially practical and concise, and full of the most instructive illustrations. It does not pretend to be anything but a survey, but will be a most useful work of reference. Once seen, a desire to possess it will certainly follow. D. C. M.

THE HARROGATE SPA MEDICAL JOURNAL. Published by Harrogate Medical Society, April 1938.

This is the first number of the *Harrogate Spa Medical Journal.* It contains a foreword by Lord Horder. The primary object of the Journal is to record the result of research done by local workers and to stimulate further research. Articles dealing with spa therapy will also be published along with matters dealing with the welfare of the spa industry. The present number contains amongst others articles by Dr. Geoffrey Holmes on "The Immersion Bath," and by Dr. Collins on "The Peripheral Circulation in Rheumatism."

The nature of the Harrogate water is also described.

Correspondence.

THE WILD PARSNIP.

TO THE EDITOR OF "THE JOURNAL OF THE ROYAL ARMY MEDICAL CORPS."

SIR,— With all due respects to your contributor, and fully appreciating his interesting article on the wild parsnip and its vagaries, my sensitive botanical instincts mildly rebel against his unintentional technical slips. A confusion of the yellow-flowered common wild parsnip, *Pastinaca sativa*, with its larger and coarser white-flowered relative, cow-parsnip or hogweed, *Heracleum sphondylium*, is a comparatively slight error, but, Sir, shades of Linnæus and Bentham! to class such rampant dicotyledons as these umbellifers amongst such painfully monocotyledons as araceæ! True, the umbelliferæ bear resemblances to the araliaceæ, the family represented by ivy in England and which your esteemed contributor may have had in mind; but our select araceæ (or, synonymously, aroideæ), to whom belong the retiring arum-lilies, which bejewel the English hedgerows in the late summer (Oh! to be in England!) must be spared the inclusion of such vulgar fellows in their distinguished family circle.

We must not be too unkind to the hardy umbellifers, however, for what saith our illustrious Culpeper of that most useful plant, the parsnip? "'Tis 'governed by Venus' and 'is hot and dry in the first degree.' The wild parsnip 'hath a cutting, attenuating, cleansing, and opening quality therein . . . . It dissolveth wind both in the stomach and bowels, which is the cholic, and provoketh urine . . . The wild being better than the tame, shows Dame Nature to be the best physician'."

The cow-parsnip, which "smelleth somewhat strongly and unpleasant," is "governed by Mercury" and is also "hot and dry in the first degree." "The seed thereof," as Galen saith, "is of a very sharp and cutting quality and therefore is a fitting medicine for a cough and shortness of breath, the falling sickness and jaundice . . . The seed hereof being drunk, cleanseth the belly from tough phlegmatic water therein, easeth them that are liver-grown. . . . The seed and root boiled in oil, and the head rubbed therewith, helpeth not only those that are fallen into a frenzy, but also the lethargy or drowsy evil, and those that have been long troubled with the head-ach, if it be likewise used with rue . . . The juice of the flowers dropped into the ears that run and are full of matter, cleanseth and healeth them."

Oddly enough, no mention appears to have been made by our astute

Elizabethan herbalist of the blistering qualities of the parsnip—a most singular fact! In view of the notorious difficulty in determining many of the umbellifers, is it not possible that such a useful, virtuous, and typically British plant as the parsnip may be quite innocent of the malicious suggestion that we are harbouring in our midst a harmless-looking but treacherous herb so unscrupulously base as to stoop to methods equivalent to modern poison-gas warfare?

Jhansi, U.P.,
January 3, 1939.

I am, etc.,
R. S. VINE,
Capt., R.A.M.C.

Notices.

UNIVERSITY OF LONDON.

SPECIAL UNIVERSITY LECTURE IN MEDICINE.

A Lecture on "The Present Position of the Cancer Problem" will be given at St. Thomas's Hospital Medical School, Albert Embankment, S.E.1, by Dr. W. E. Gye, F.R.S., Director of the Imperial Cancer Research Fund, at 5 p.m., on Monday, March 20, 1939. The Chair will be taken by Sir Cuthbert Wallace, K.C.M.G., C.B. The Lecture, which will be illustrated with lantern slides, is addressed to students of the University and to others interested in the subject. Admission free, without ticket.

S. J. WORSLEY, *Academic Registrar.*

"WELLCOME" BRAND TUBERCULIN P.P.D. PURIFIED PROTEIN DERIVATIVE.

"Wellcome" Brand Tuberculin P.P.D. Purified Protein Derivative, the introduction of which for diagnostic purposes is announced by Burroughs Wellcome and Co., is prepared by a method resembling that described by Dr. Florence Seibert (*Amer. Rev. Tuberc.*, 1934, **30,** 713). It may be regarded as the active principle of tuberculin, and appears to possess the following advantages: (i) Constancy of composition and potency; (ii) absence of non-specific substances; (iii) stability in the dry state, and (iv) ease of preparation of dilutions. The product, which is prepared at the Wellcome Physiological Research Laboratories, Beckenham, Kent,

is available in three strengths, designated Nos. 1, 2 and 3. Each packing contains a sufficiency of dried P.P.D. and of a special borated solvent to prepare 1 cubic centimetre (10 test doses) of a 1 : 10,000, 1 : 1,000, or 1 : 100 solution respectively. While solutions must be used on the day of preparation, the dried P.P.D. is exceptionally stable, and has shown no detectable loss after several years at room temperature.

THE PARKES MEMORIAL PRIZE, 1938.

In the absence of any recommendations for the award of the Parkes Memorial Prize for the year 1938, the Committee administering this Prize Fund has decided to withhold the award for the year referred to.

The Parkes Memorial Prize consisting of a gold medal and £30 is awarded annually to the officer who is considered by the Committee to have done most to promote the advancement of Naval or Military Hygiene.

In awarding the prize for 1939 and thereafter until further notice, first consideration will be given to original articles or reports of investigations of value from the point of view of Naval or Military Hygiene, and published in one or other of the various medical journals.

The prize is open to Medical Officers of the Royal Navy, Army, and Indian Army, with the exception of the teaching staffs of the Royal Naval Medical College, Greenwich, the Royal Army Medical College, London, and the Army School of Hygiene, Aldershot.

EDITORIAL NOTICES.

The Editor will be glad to receive original communications upon professional subjects, travel, and personal experiences, etc.

Correspondence on matters of interest to the Corps, and articles of a non-scientific character, may be accepted for publication under a nom-de-plume.

All Communications or Articles accepted and published in the "Journal of the Royal Army Medical Corps" will (unless the Author notifies at the time of submission that he reserves the copyright of the Article to himself) become the property of the Library and Journal Committee, who will exercise full copyright powers concerning such Articles.

A free issue of twenty-five reprints will be made to contributors of Original Communications and of twenty-five excerpts in the case of Lectures, Travels, Clinical and other Notes, and Echoes of the Past.

Reprints or excerpts, additional to the above, can be furnished on payment if specially ordered at the time of submission of the article for publication.

Communications in regard to editorial business should be addressed—"The Editor, JOURNAL OF THE ROYAL ARMY MEDICAL CORPS, War Office, Whitehall, London, S.W. 1."

MANAGER'S NOTICES.

The Annual Subscription for the JOURNAL OF THE ROYAL ARMY MEDICAL CORPS is £1 payable in advance. Single copies, 2s. 6d. per copy.

Cheques, etc., should be made payable to the "Journal R.A.M.C.," and crossed "Holt & Co."

Each subscriber who pays his subscription direct to the Manager will also receive monthly a copy of "The R.A.M.C., The A.D. Corps, and Q.A.I.M.N.S. *News and Gazette*."

Communications in regard to subscriptions, change of address, etc., should be addressed "THE MANAGER, JOURNAL OF THE ROYAL ARMY MEDICAL CORPS, A.M.D.2, WAR OFFICE, WHITEHALL, LONDON, S.W. 1."

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No. 4. April, 1939. Vol. LXXII.

Journal of the Royal Army Medical Corps

ISSUED MONTHLY

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VOL. LXXII. APRIL, 1939. No. 4

Journal
of the
Royal Army Medical Corps.

Original Communications.

THE MEDICAL PROBLEMS OF A BASE AND OF THE L. OF C.[1]

BY COLONEL P. S. TOMLINSON, D.S.O.

THIS lecture has broken away from the routine of those of the winter period of training, which usually deal with the duties of a Regimental Medical Officer or of a Field Ambulance Commander, or of a Divisional Field Hygiene Section.

The problems are such as may affect in some way or other all medical officers and senior other ranks no matter what their rank, or what speciality they favour in peace, and therefore it behoves us all to study the different manuals which deal with them.

The manuals most concerned for quick reference are :—

Official.

Field Service Regulations, Vol. I, 1930.
Manual of Movement (War), 1933.
Instructions for Movement Control, 1938.
R.A.M.C. Training, 1935.
Official History of the War (Medical Services of the Army).

Unofficial.

Lieut.-Col. T. B. Nicholl's useful book, "Organization, Strategy and Tactics of the Army Medical Services in War."

(1) What is the meaning of a Base and the L. of C.? The series of

[1] Based on a Lecture given at the Queen Alexandra Military Hospital, Millbank, to Officers, Warrant Officers and Non-Commissioned Officers, R.A.M.C.

definitions on pages xvi to xxii in Field Service Regulations, Vol. I, might well be our first study.

The definition of a "base" is given as "a sub-area organized to include two or more depots of men, animals or material."

The definition of "L. of C." is given as "the system of communications in a theatre of operations between the bases inclusive and the rear limit of administration by formation commanders (i.e. Corps or Divisional), along which the requirements of the field army are transported."

(2) The base is the group of depots and installations (*vide* definitions) established by the various services in the theatre of operations. In the case of our forces, who in the majority of cases are working overseas, the bases will be established in the vicinity of a port or ports of entry in order to expedite the reception of personnel, animals, vehicles, materials, supplies, and to facilitate the evacuation of casualties from the theatre of operations (Manual of Movement, Section 52).

Lieut.-Colonel Shaw, R.A.O.C., in his interesting book, "Supply in Modern War," describes a base as "the source whence power and mobility, where life itself and its expression in war must spring. It furnishes the ration, forage and fuel, which ensure movement, and also the wherewithal to fight, i.e. the natural supply and the war supply of a force."

The constituents of a base are as stated in Sections 56-58 of the Manual of Movement:—

(i) The docks, which are solely a transit locality.

(ii) The depots.

(i) The transit locality consists of the docks, the various installations concerned with the loading of shipping and the clearance of cargoes, and with such railways or inland water transport organizations directly concerned with this work.

Dumps and depots should be avoided in the docks or only used very temporarily. This rule was frequently disobeyed in the Great War, causing confusion and delay in getting personnel and material clear of the docks and forward to the concentration area (*vide* Manual of Movement, Section 10).

(ii) The depots must each be located separately. The chief are: (*a*) Personnel camps for troops in transit, infantry and general base depots. (*b*) Personnel camps for civil labour (at docks or depots). (*c*) Hospital and Convalescent Depots and Base Depot Medical Stores. (*d*) Veterinary and Remount Areas (Veterinary Hospital Stores and Convalescent Camp). (*e*) Ammunition Depots. (*f*) Main Supply Depot and Detail Issue Depots (frozen meat, bakery, N.A.A.F.I. Canteen Stores). (*g*) Petrol and Oil Depot (P.O.L.). (*h*) M.T. Stores Depot. (*i*) M.T. Vehicle Reception Depot, R.A.S.C. (*j*) Ordnance Stores Depot (General Stores and Returned Stores Depot). (*k*) Depot for Work Services and

Engineer Stores Service. (*l*) Transportation Stores Depot (stores in connexion with all transportation services, especially railway and inland water transport equipment, etc.). (*m*) Post Office, M.F.O. and Printing and Stationery Service. (*n*) R.A.F. Area (Stores Depot and Vehicle Park). (*o*) The various workshop and repair organizations connected with above. (*p*) R.N. Stores. (*q*) Base marshalling yard.

(3) To meet the preparations needed for the docks and depots of such a base, arrangements must be made for the reception of the force, its protection, immediate maintenance and accommodation.

Before any landing takes place it is essential that these preliminary plans should be drawn up for the maintenance of the force and the lay-out of the base.

These preliminary plans lay down the tentative proposals as to the methods by which the force shall be maintained, and are set out as administrative orders, known as "the maintenance project."

They also lay down the manner in which the base shall be laid out and depots on a large-scale plan called the "First Key Plan."

An advance party is sent to make these necessary arrangements (*vide* Manual of Movement, Section 55 (i)). This advance party will have a senior R.A.M.C. officer among its members to make the medical and sanitary arrangements.

As a result of the more reliable information collected by this advance party a more amended project is substituted, and a Second Key Plan shows the definite allotment of areas for the depots and installations. Later even a Third Key Plan may be issued to meet the permanent maintenance scheme.

In fixing the number and nature of the administrative units, the decision will depend on the nature of the country, the degree of development existing at the base port, also the facilities in the country for construction. What would suit France would not suit Irak, Palestine, West Africa, e.g. consider the different types of medical transport and equipment used in the Great War (*vide* R.A.M.C. Training, Chapter XX).

Usually the following units will be essential :—

(i) R.E. (Transportation): Railway survey, construction and operating companies and dock companies.

(ii) R.E. (other than Transportation): Field survey, electrical and mechanical companies, workshop and park field companies.

(iii) Signal units.

(iv) R.A.S.C. supply and transport units, both for maintenance and for the initial supply and transport work occasioned by the landing of the force (butchery, bakery, frozen meat store, other supplies, M.T. Company for transport in base).

(v) Medical and veterinary.

(vi) Ordnance (Store Company, Workshop Company, Ammunition Company).

(vii) Pay and Provost—Post and Publications.

(viii) Base depots for personnel (troops, Labour Corps).

The advance party sets aside sites for temporary lay-out to meet the immediate arrival of the troops, and sites for the permanent lay-out. Sometimes the base for the temporary lay-out may be a different one to the base for the permanent lay-out.

The type of depot for personnel or animals or stores will assist in determining its locality.

(*a*) Personnel camps should be within easy marching distance from the landing places, to allow of a short march to camp.

(*b*) Hospitals should have easy access to broad-gauge railway and to the docks for loading hospital ships, also near a good main road. They should not be too near personnel camps or store depots in case of bombing.

(*c*) Petrol and ammunition should be well apart from all other depots and from each other, also on sidings away from main lines on ground suitable for concealment.

(*d*) M.T. on suitable ground of wide area for M.T. standings and near access to road and railway.

(*e*) The base marshalling yard is an important depot for marshalling trucks from other depots (Ordnance, S. and T., R.E. Stores, etc.) to make up full trains. (Manual of Movement, 1933, Section 68, and Instructions for Movement Control, 1938, Section 18.) This is placed forward of all other depots of the base ready to accept a forward flow of vehicles from other depots.

In addition to these depots are the A.A. defences for the base sub-area.

We have thus got the numerous depots and installations for which medical arrangements must be made.

(4) The medical problems of the base concern the following :—

(i) Medical base—other bases.

(ii) Sanitation in all bases.

(iii) First aid at rest camps.

(iv) First aid at docks.

(v) Medical aid to other depots.

(vi) Medical transport in the base sub-area.

(vii) Supply of medical stores at the base.

(viii) Transport of casualties by train to the base.

(i) The Medical Base is a separate base set aside for medical duties only. The enemy must be informed of its position and its work as a medical base.

It has no air-defences nor combatant units in it, and therefore should not be subject to interference by enemy from the air or by other form of attack.

The Detail Issue Depot for supplies and possibly a small Ordnance Store are the only units other than R.A.M.C. in its area and are placed near a suitable rail-siding taken off from that for ambulance trains.

The Medical Base Commandant is a D.D.M.S. with the usual assistants and hygiene expert, five consultants in special subjects, and E.M.O., assisted by two "Q" officers for transportation and other departmental officers.

The lay-out includes: (*a*) General Hospitals (600 or 1,200 bedded). (Two or more must arrive with the first combatant units to deal with the early wounded or routine sick). (*b*) Ambulance trains with special sidings for unloading. (*c*) Ambulance Car Company. (*d*) Field Hygiene Section (this should arrive almost first of all units). (*e*) Base Depot Medical Stores. (*f*) Convalescent Depots. (*g*) A Detailed Issue Depot (D.I.D.), with R.A.S.C. detachment, for supplies of the whole base. (*h*) An Ordnance store for blankets, and other Ordnance stores for hospitals. (*i*) Hospital ships. (*j*) Quays for hospital ships.

This base will take the chief percentage of all casualties from the front and therefore must have room for expansion in size and number of its General Hospitals.

Other bases will each have (*a*) a 600-bedded hospital, or a section of such a hospital (or a 200-bedded hospital, if re-established), for the sick and casualties among their occupants, depending on the size of the base, also (*c*), (*d*), and (*g*), above.

(ii) Sanitation: A Field Hygiene Section will be required as one of the first units of the whole force to arrive in each base, as sanitation of all ports, especially foreign ports, is at all times bad. In large bases the unit will have to be split into sub-sections, e.g. one being placed at the docks, another at rest camps for troops or for labour, and another near the large store depots, and so on.

(iii) Medical arrangements at Rest Camps: A M.I. Room will be established, and possibly a small detention or reception station of a few beds to detain mild cases at the rest camp, at infantry or general base depots. The base depots have two medical officers allotted to them.

(iv) Medical arrangements at Docks: At most docks of large ports civil first-aid posts are already established. These can be elaborated with extra R A.M.C. orderlies, with suitable medical and first-aid necessaries. The E.M.O. or a special M.O. (e.g. M.O. i/c Labour Company at Docks) will be in charge. Accidents will certainly happen, and sick require early attention.

(v) First Aid at other large depots with numerous personnel: Medical Officers in charge of Labour Companies or base depots will probably be in medical charge of other large nearby depots not provided with medical officers, e.g. Base Ordnance, S. and T., and R.E. Depots, and workshops, ammunition depot, or base marshalling yard.

(vi) Medical transport in the base sub-area: An Ambulance Car Company (a R.A.S.C. unit), now consists of a headquarters and five sections of twenty-five cars each. The unit may be split up, e.g. one section may be at each ordinary base and two or more sections and headquarters at the medical base. This unit evacuates cases from ambulance trains to general hospitals, and from general hospitals to hospital ships or to convalescent depots, and acts locally to bring in cases from base depots to hospitals.

(vii) Supply of medical stores at the base: A Base Depot of Medical Stores is a large unit established at the medical base usually near a railway station or siding in a large dry warehouse with a good road access. This supplies general hospitals, advanced depots of medical stores, ambulance trains and emergency supply in hospital ships, though the latter's routine supplies come from the base depot medical stores at the home base.

(viii) Transport of casualties by train to the base: Ambulance trains are not normally base units but L. of C. units. They are re-stocked at the garage or ambulance train depot, after evacuating their casualties at the base, from stores received from the base medical stores depot.

The medical staff of other base sub-areas consists of an A.D.M.S., a D.A.D.H., and an E.M.O. (if a port), and eight M.O.s, two in charge of the Labour Companies at the base, and six at the disposal of A.D.M.S. for emergency, transit, and other duties.

Hygiene and sanitation will be the foremost medical questions in these bases.

(5) Line of Communication—see definition under (1) above. This line includes rail-heads, road-heads, or river-heads, e.g. in Abyssinia the Italians had road-heads, and in Mesopotamia in the Great War there was a river-head. Lieut.-Colonel Shaw, R.A.O.C., describes the Line of Communication as the "Umbilical Cord joining the mother (i.e. the base) to the child (i.e. the force)." How glad would any G.O.C. be nowadays if only the "child" could be free of its "mother," and self-supporting. The Line of Communication must, however, be visualized as an area rather than the line of a railway, river or other artery of communication since in this area are located all the administrative installations, similar to those at the base in a more advanced area. These again must be suitably dispersed.

The units and depots on the Line of Communication are rail-head depots of Ordnance, S. and T., and R.E., rail-head and L. of C. A.A. Bdes., C.C.S.s, M.A.C.s, Advanced Depot of Medical Stores, Convalescent Depots, Regulating Stations [*vide* Manual of Movement, 1933, Sec. 68 (2)], Advanced General Hospitals, Advanced Base Depots, Workshops, Repair Shops, M.T. Companies on L. of C., Ambulance Car Companies on L. of C., N.A.A.F.I. Canteens, Ambulance Trains and garages. Few

of these units have their own M.O., so that in times of quiet M.O.s from C.C.S., Advanced General Hospitals and M.O.s i/c. definite units (e.g. M.T. Companies, and A.A. Bdes.) can look after troops in the L. of C. area.

A small pool of M.O.s for each L. of C. sub-area under the A.D.M.S. of the L. of C. sub-areas, similar to the pool of M.O.s at the base sub-area, is now being added to meet the shortage of M.O.s in that sub-area, and they could be located at regulating stations or other central places. This addition is of great advantage as M.O.s of C.C.S.s and Advanced General Hospitals will be far too busy during operations to manage the numerous small units and depots.

Air attack on the L. of C. will necessitate the presence of M.O.s at or near the different depots or installations to meet immediate medical calls.

The Medical Staff has a D.D.M.S., A.D.M.S., D.A.D.M.S. and A.D.H.

(6) The chief duties of the D.D.M.S., L. of C. area, or A.D.M.S. L. of C. sub-area, are as follows :—

(i) Hygiene: By far the most important are early and strict sanitation and hygiene, otherwise the ground will be rapidly fouled, and a disease-carrier sooner or later start an epidemic or upset the health of the troops passing along the L. of C. This necessitates the very early arrival of the A.D.H. and of a Field Hygiene Section in the L. of C.

(ii) Evacuation of casualties: To establish the medical units as early as possible so as to maintain the necessary flow of casualties down the line, i.e. C.C.S., M.A.C.s, Ambulance Trains, Advanced General Hospitals (these are necessary along the L. of C. in these days of intense bombing), Convalescent Depots.

(iii) Medical aid at regulating stations and railway rest stations: To get aid for troop trains up and ambulance trains on the down journey and for local casualties. P.A.D. First Aid Posts will be needed at all such stations. A separate M.O. must be available at each such station.

(iv) Ambulance trains: To establish these, or temporary ambulance trains, early, and to co-ordinate their routine work through the movement control on G.H.Q. in order to obtain an even evacuation to clear the expected casualties of the force in front of rail-head. (This may be co-ordinated direct by D.M.S. Force, or as in the Great War a D.D.M.S. i/c. Ambulance Trains, established). Brechot or Tintner or other suitable variety of apparatus must be early available (R.A.M.C. Training, para. 476).

(v) Medical P.A.D.: Establish at all medical units and large depots medical first aid posts to deal with wounded contaminated personnel.

(7) I am aware this lecture is sketchy, and only gives an outline of the medical problems which may crop up, but if it stimulates all ranks to look up further details in the various official manuals or unofficial books, it will have attained its object.

AN ACCOUNT OF THE ANNUAL TRAINING OF A CAVALRY FIELD AMBULANCE (1938).

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Some five years ago the 170th Cavalry Field Ambulance—at that time the only Cavalry Field Ambulance in the Army—was entirely re-organized and given a form which differed completely from anything hitherto in existence. Those who recollect the old Cavalry Field Ambulance of war days will remember that it was ill-adapted for the collection of wounded from cavalry units, and in consequence it was partially re-organized for the later Palestine campaign.

The new establishment was adopted with enthusiasm by the unit since it was realized that it was now possible to keep up with and evacuate the wounded of cavalry units in an efficient manner. Whether this will apply when mechanized forces have to be dealt with is another matter.

During the last four years, even with the inadequate equipment at our disposal, we have been able to realize to some extent the possibilities of our new formation, while the work put in and the trouble taken by the late Commanding Officer, Colonel Sandiland, T.D., in organizing the basic training of the unit has enabled us to take some steps forward.

This year, the unit found itself with junior officers who had little or no experience in field work, and the seniors felt that the annual camp should be utilized especially for the training of these officers and our programme was drawn up accordingly.

The peace establishment (plus 10 per cent increase) of the Cavalry Field Ambulance is 7 officers and 68 other ranks; 7 officers and 60 other ranks came to camp. The equipment allows us to form one more or less complete A.D.S. and a second very skeleton A.D.S., just the barest bones. Two bearer sections were formed, though our allowance of motor vehicles rendered their transport difficult.

With the equipment and transport at our disposal, the formation of even a skeleton M.D.S. is quite impossible. The study of the use of ambulance cars is equally impossible though it will be appreciated that this factor is even more important with us than it is with an ordinary Field Ambulance (mechanized).

Our basic training therefore is limited to schemes for the instruction of personnel in A.D.S. formations and the duties and tactical use thereof.

While this is quite satisfactory for the instruction of junior officers whose duty it will be to handle these sections in war, it does not give the necessary tactical experience to the seniors in the command of the ambulance as a whole and they have to fall back on the less satisfactory alternative of T.E.W.T.s. This is particularly unfortunate when we have to cope with an entirely new type of unit where experience in the last war is of little help.

The following table shows our programme of training for the annual camp of 1938:—

FIRST WEEK.

	Sunday June 26	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
MORNING		Raining	Raining	Fine	Fine	Fine	Fine
	Liverpool to Isle of Man	Settling in. Reading of Army Act, etc.	Equipment, etc., of A.D.S. demonstrated	Preliminary A.D.S. and bearer exercises under section commanders	As Wednesday	As Wednesday	Combined A.D.S. and bearer exercises directed by senior officers
AFTERNOON	Arrival [illegible] — Medical inspection of all ranks	Lecture to officers on messages — Lecture to O.R.s on gas	Lecture to officers on A.D.S. — Anti-gas training	Officers' treasure hunt	Officers' map-reading exercise — Pay parade	Officers' road reconnaissance report — N.C.O.s map-reading	Half-day

SECOND WEEK.

	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
MORNING	Church Parade	As on Saturday	As on Saturday	Late reveille — Lectures and squad drill	Heavy rain	Heavy rain	Men required for packing up Officers on schemes	Left at 8.40 a.m. for Liverpool and Bebington
AFTERNOON	Nil	Officers' M.D.S. Report	T.E.W.T. for N.C.O.s — Night ops.	Unit Sports			Packing up	

TRAINING PROGRAMME.

The unit was unlucky in the weather. There were several days of heavy rain and nights of gales and rain which cut down the time available for training, and this prevented us from attempting a medical scheme for combined landing operations based on an excellent command administrative exercise which two of us had the good fortune to be able to attend.

Sunday, Monday and Tuesday require no discussion.

The preliminary exercises carried out on Wednesday, Thursday and Friday are as follows:—

Bearer Exercises.

(1) Loading and unloading of a Bearer Section lorry, including mounting and dismounting of personnel of Section.

(2) Movements in extended order.

(3) Movements of individuals and single squads over an area of ground (*a*) not under fire; (*b*) under fire.

(4) Front line treatment of wounded in the open (*a*) under fire; (*b*) not under fire.

(5) Removal of wounded.

(6) Various hand carries.

(7) Tethering and coupling horses.

(8) Removal of a wounded man from a horse.

(9) Carrying verbal messages.

(10) Passing verbal messages along a line of bearers.

(11) Carrying of loaded stretchers across hedges, ditches, streams, walls and rivers.

(12) Carrying loaded stretchers over rough country.

(13) The use of hand carries for evacuating wounded over rough country.

(14) Loading and unloading of ambulance cars with reduced number of bearers.

A.D.S. Exercises.

(1) Loading and unloading A.D.S. Section lorry, including mounting and dismounting personnel and moving off in column of route.

(2) Construction of latrines, urinal pits, kitchen, etc.

(3) Making improvised shelters.

(4) Instruction in contents and uses of medical and ordnance panniers and other stores of A.D.S. Section.

(5) Clerical duties.

(6) Carrying verbal messages.

(7) Pitching, running and stocking A.D.S.

These preliminary exercises are more or less standardized but the fact that ground can be chosen by officers commanding sections prevents the

exercises becoming mere routine. They were given variety this year by the imaginative capabilities of the junior officers.

In the afternoons of Wednesday, Thursday and Friday, and Monday of the second week, a number of exercises were arranged for junior officers and those R.M.O.s able to attend.

(1) *Treasure Hunt.*

With reference to this, full details are given in an article by Lieut.-Colonel E. R. Lovell, T.D., 164th (W.L.) Field Ambulance. One treasure hunt for officers was carried out in cars without a hitch. They were, however, somewhat mystified by the first map reference (a "misprint") which would have meant a swim of several miles. This was speedily corrected by the directing staff, who pointed out that errors of this kind should be spotted before moving out of camp to look for the reference.

(2) *Map Reading.*

This exercise took the usual form. It was interesting to note that the outstanding feature, Snaefell, with a hotel on the summit, was at first missed by everyone.

(3) *Road Reconnaissance Report.*

A road was chosen which started as a tarmac road fit for two lines of traffic, but with a dangerous bridge and hill requiring great caution in the first hundred yards. It deteriorated into a narrow one-way track after three miles. There were a few buildings on either side. The officers were asked to write a general report on the road and to answer certain specific questions:—

(1) How far two-way traffic could be used.

(2) How far beyond this one-way traffic could be employed.

(3) Methods of traffic control to be used.

It was assumed that this road would be used solely by the medical services.

This exercise led to a useful discussion on methods of traffic control in the front line area. It also brought out the importance of a knowledge of apparently insignificant details, e.g., on account of the narrowness of the road in two places it was essential to know the breadth of the ambulance cars and lorries to determine whether they could use the track.

The R.M.O.s failed to realize the capabilities of six-wheeled ambulance cars and six-wheeled 30-cwt. lorries over rough ground. This offered no difficulties to the young officers of the field ambulance, who, as a result of their training, are never optimistic enough to expect to have the use of tarmac roads.

(4) *Report on M.D.S.*

A farm with many out-buildings was chosen and officers were asked to inspect it and submit a scheme for the use of the buildings as an M.D.S

The officers showed commendable enthusiasm and all solutions approximated closely to the "official" one.

A.D.S. Exercises.

In these exercises one of the directing staff acted as an umpire and drove with the O.C. of the section, keeping him posted at the requisite times and places as to all happenings—heavy fire, gas attack, etc —on which the O.C. section had to decide what to do and issue orders accordingly. All exercises were designed to teach the necessity for rapid appreciation of situations, issuing of clear orders to deal with such situations, and the importance of adequate reconnaissance of minor roads before committing sections to them.

The sections of a cavalry field ambulance are extremely useful for the training of young officers and N.C.O.s in that they only require a small number of men and vehicles and the nature of their work ensures that they must be capable of acting independently. In war they will have to deal in the main with the casualties of a regiment, and it will be observed that these schemes are set from the point of view of a single cavalry regiment. Criticism may be offered to the effect that these schemes are scrappy and unorthodox, that a very important person, the O.C. Field Ambulance, never figures, let alone that man of power, the A.D.M.S. When one considers, however, the mobility of this unit and the long distances over which it will have to work, it is obvious that the O.C. of an A.D.S. section will often have to act on his own responsibility without orders from higher authority. He must, however, keep that authority fully informed as to his movements and the situation in general from his point of view, and thus the importance of intercommunication is emphasized as a primary necessity. This was made quite plain in all our exercises by the sending and receipt of many messages.

In these exercises the units or sub-units consisted of an A.D.S. section with bearer section attached.

A.D.S. Exercise No. 1.[1]

Preliminary narrative handed to A.D.S. Commander before leaving camp.

The Isle of Man is an important outpost of Anglia. Hibernia, to enforce a trade treaty, decides, without declaring war, to occupy the Isle of Man, the defences of which have been very much neglected. The Anglian naval forces are fully occupied in the Mediterranean and the North Sea and this unexpected attack will be a complete surprise.

The main force is landing on the west coast of the island, but a small

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[1] The map used in all the exercises is the 1 inch Popular Edition (Isle of Man), Sheet 17.

cavalry force has landed at Ramsay, consisting of two regiments: 3rd and 4th of cavalry, 170th Cavalry Field Ambulance, and auxiliary services.

It is now advancing on Douglas in two columns.

Column 1.—4th Cav. Regt. via Laxey to Onchan. The coast road is completely blocked at Old Chapel (909050) and road South Cape (9106)—Pt. 568 (902063) is only passable for cavalry. The force reached Laxey at 06.00 hrs., July 2, and meeting with little resistance, it is now advancing towards Onchan.

Column 2.—3rd Cav. Regt. is advancing along main road Ramsay—Pt. 1384 (872087).

Inter-column boundary:—

Ballure (935159)—Pt. 738 (927125).

Pt. 978 (912122)—Pt. 742 (889096).

Cronk-y-Vaare (8808)—Ballacowin (8807)—Inn (8604)—Slagaby (8603).

A.D.S. will evacuate the wounded from Column 1.

The R.V. for this exercise is the Queen's Hotel at Laxey, and you will arrive there in time to move off at 09.30 hrs.

The Exercise.

(1) On arrival at R.V., A.D.S. Commander is handed the following message: Have opened R.A.P., Farm (888042). Twelve casualties for evacuation. Regtl. Hqrs. moving forward to Begoade (885046). R.M.O.

(2) As A.D.S. passes Lonan Church Yard Gate (906055) a small group of wounded is found.

(3) Between Lonan and Chibbyr Pherric (898058) the A.D.S. comes under gas spray from aeroplane.

(4) A.D.S. arrives at Farm (888042). It pitches A.D.S. and clears the area round Garoo (8804). Meanwhile, information is received that the road is blocked at 887038.

(5) Towards the end of the evacuation, the following message is received from the R.M.O. 4th Cav. Regt. Have opened R.A.P. Begoade (885046). Fifteen casualties await evacuation. Regt. advancing to Onchan (8700).

The following are the official solutions for the situations described above:—

(1) On receipt of the message, the A.D.S. moves off to the R.A.P. mentioned in the message by the best available route. The block in the main road mentioned in the narrative made it necessary to turn off by a side road through Lonan. This turning could easily be overlooked by a harassed A.D.S. commander.

(2) O.C. A.D.S. should have the wounded dressed, if this has not already been done, and send D.R. back to Laxey to the M.D.S. with

a message giving the location and number of these wounded and should tell the D.R. his destination and also to return at once. He should delay his A.D.S. for as short a time as possible.

(3) Put on respirators, remain seated in lorry and cover the exposed parts with ointment.

(4) As mentioned in the problem.

(5) On account of the blocking of the road, it will be necessary to proceed down two poor farm tracks so as to avoid block. These he should reconnoitre personally before taking his Unit along them. On arrival at Begoade (885046) he will again pitch A.D.S. and clear wounded.

A.D.S. Exercises No. 2 *and* 3.

These exercises have one preliminary narrative: Owing to the treacherous activities of disloyal persons, the Government of the Isle of Man has declared its separation from the parent government and, encouraged by imports of arms from sympathetic continental countries, has a small army well trained to resist any attempt at coercion.

The mother country has landed a force of 3 Brigades of Cavalry at Douglas to quell the rebellion; this force is advancing in three columns northwards towards the seat of the rebel government at Ramsay.

Column 1.—Along coast road Douglas—Derby Castle (8799)—Inn (8900)—Laxey (9106)—Cardle (9312).

Column 2.—Along road Strathallen Park (8700)—Onchan (8700)—Cronk-Ny-Mona (8601)—Keppel Gate (8604)—Bungalow Sta. Hotel (8709).

Column 3.—Douglas—Quarter Bridge (8498)—Strang (8300)—Baldwin (8203)—Injebreck (8307).

Column 1 is responsible for area:

Right flank boundary: Road Onchan—Laxey.

Left flank boundary: Road Pt. 357—Begoade (8802)—fork road (8803)—Pt. 856 (8805)—line to Pt. 590 (8907)—Clagh Ouyr (8911).

Column 2 is responsible for area on left flank of Column 1 to excl. Road Cemetery (8599)—incl. Strenaby (8403)—Dhoon (8506)—Beinn-y-Phott (8508).

Column 3 is responsible for area on left flank of Column 2.

Exercise 2.—The A.D.S. is responsible for Column 3 and will R.V. on Injebreck road, 100 yds. north of Quarter Bridge Hotel (843987).

(1) A.D.S. Commander receives the following message from O.C. Cav. Fd. Amb.: Cav. Regt. is in action in region of Injebreck House and R.A.P. has been opened at the house itself. You will advance to Injebreck House with your A.D.S. and evacuate casualties to the M.D.S. at Douglas.

(2) A.D.S. advances, and north of Strang (8300) has warning of aeroplanes in neighbourhood.

(3) Untreated wounded gathered in a clump are found at the roadside at Pt. 416 (831022).

(4) The high ridge south of Baldwin is found to be under fire.

(5) At the south end of the reservoir A.D.S. comes under shrapnel fire. The A.D.S. Serjeant and Bearer Section Corporal are severely wounded.

(6) A.D.S. arrives 200 yds. south of Injebreck House and cannot get nearer on account of road block.

(7) Regiment advances and R.M.O. leaves his wounded in charge of A.D.S. Commander. He informs A.D.S. Commander there are more wounded to the north of Injebreck House.

(8) While the treatment and evacuation of wounded are going on at A.D.S., O.C. receives message that the bridge south of Baldwin has been bombed and destroyed by aeroplanes.

Official Solutions of Above.

(1) On receipt of message, A.D.S. Commander moves off with section to Injebreck.

(2) On receipt of warning, puts on speed and rushes to a clump of trees a short distance ahead. As the aeroplanes are not yet in sight, this is better than stopping in the open road.

(3) Gives first aid treatment to the wounded but does not attempt to evacuate them and, as in the previous exercise, sends back D.R. to the M.D.S.

(4) Passes across the ridge at speed.

(5) This situation has been put in to give practice to the more junior members of the section. A.D.S. Commander should report these casualties to the O.C., Cav. Fd. Amb.

(6) O.C. pitches A.D.S. at this point and sends the bearers forward to the house on foot to bring back the wounded by hand carriage.

(7) A.D.S. Commander asks R.M.O. for all the information he has regarding location of the wounded and as by now his bearers will probably have evacuated the casualties from the R.A.P., he sends them forward to bring back the wounded in the open. A.D.S. Commander will also find out from the R.M.O. the probable lines of advance of his regiment.

(8) If he is too busy himself, which is very probable, he will send his D.R. back to reconnoitre the side roads shown on the map. The latter will find that, although these are shown as poor third-class roads, they have actually been repaired since the map was made and there is an excellent line of evacuation back to Douglas which avoids the damaged bridge south of Baldwin.

Exercise 3.—You are attached to the 2nd Column and will evacuate their casualties.

The road Strathallen Park (8700)—Onchan (8700)—Cronk-Ny-Mona

(8601)—Bungalow Sta. Hotel (8709) is reserved for fighting troops and supplies.

The A.D.S. will R.V. at Onchan at 09.30 hrs. where O.C., A.D.S. receives the following message: 2 A.D.S., 170th Cav. Fd. Amb. from Cav. Regt. have opened R.A.P. Grange (8703). Regt. in action Slieu Meayl (8704). 10 casualties to date. Signed R.M.O. Time of origin, 09.15 hrs.

(1) On passing cross roads (873023) he receives aeroplane warning.

(2) Arrives at Grange. R.M.O. tells him he is going on with his Regt. He has 20 wounded in his R.A.P. and some are lying out in area north of R.A.P. He informs A.D.S. Commander that the road to the north is impracticable for motor vehicles.

(3) When evacuation nearly complete, A.D.S. Commander receives the following message from R.M.O.: I have opened R.A.P. at White House (882052) and have a number of wounded.

(4) Proceeds to White House (882052). Finds the Regt. has advanced, the M.O. has been killed and the only orderly is stupid.

There is no need to go through again the official solution of all the situations in this exercise, but an interesting situation developed in the advance from Grange to White House. The O.C. should do a personal reconnaissance in front of Grange despite the fact that the R.M.O. has told him that the road is impracticable. That worthy gentleman may not realize the sort of ground over which it is possible to take Cav. Fd. Amb. vehicles. Actually, the reconnaissance reveals that the R.M.O. had spoken the truth and it was necessary to try some other route. It turned out that there was only one possible route, the one which had been reserved for fighting troops and supplies only. With all humility, the directing staff suggests that this is one of those occasions where orders should be disobeyed and this route taken. In the exercise, when the A.D.S. took this route, the umpire turned himself into an infuriated and liverish senior Staff Officer, who wanted to know, with many expressive adjectives, why this unit was on that road. On getting a satisfactory answer, he allowed the unit to proceed. In all these exercises, although it has not been mentioned, emphasis has been laid on the fact that messages describing any incident of importance had to be sent back to the O.C. and the M.D.S. either by ambulance car or, if absolutely necessary, by D.R.

Minor points noted by the directing staff:—

(1) That it is most important to keep N.C.O.s and men fully informed of the situation.

(2) All N.C.O.s must read a map with intelligence and care.

(3) Personal reconnaissance is essential. The importance of this was clearly demonstrated during this camp. The condition of many of the roads, etc., has altered considerably since the map was last amended.

(4) The motor cycle D.R. of the A.D.S. must not be detailed for minor duties which could be carried out by a runner or returning ambulance car. He must be kept for really important and urgent messages.

(5) The D.R. must be thoroughly well trained in map-reading. (In actual fact, our transport section from 2nd Cav. Div. R.A.S.C., was a most capable one; the members of it drove well and had a sound knowledge of map-reading.)

(6) Section Commanders must realize that when pressed they must ask for vehicles, which will not be sent to them unless full information is given as to why they are required. The exact numbers of casualties and their location must be stated.

(7) All personnel must be thoroughly conversant with signals for convoys of vehicles.

ORDER FOR MARCH ON THE NIGHT OF JULY 5-6 BY 170TH CAVALRY FIELD AMBULANCE.

(1) From camp to R.V. Union Mills (831004) by road Onchan—Quarterbridge (8498)—Union Mills.

(2) Move from rendezvous at 23.15 hrs. and proceed by road Strang (8300)—Castleward (8401)—Bridge over River Glass (8401)—Glenville (8502)—Cronk-Ny-Mona (8601)—Gobnagear (8603)—Inn (8604)—Pt. 856 (8805).

(3) Reassembly point, immediately west of the Road Junction Brundal side road and main road (896057). Vehicles facing towards Laxey. Time of reassembly will be communicated later.

(4) The column will consist of No. 1 A.D.S. Section, less D.R. with No. 1 Bearer Section and Ambulance car attached. Officer commanding will move in four seater car in front of column accompanied by two D.R.s. 2nd in command will move in rear of column in four seater car accompanied by one D.R.

(5) O.C. No. 1 A.D.S. will be responsible for the pace of the column which will be a maximum of fifteen miles an hour to R.V. and twelve miles an hour from R.V. forward.

(6) The column will move in two blocks, 1, A.D.S. Section and attached, and 2, A.D.S. Section and attached; an interval of fifteen yards between vehicles and an interval of forty yards between blocks will be maintained by the column.

(7) At the halt there will be two yards' interval between vehicles and twenty yards between blocks.

(8) Inter-communication will be by D.R.

(9) The halt signal will be two short blasts. The start up signal one long blast. Signals will be passed down the column.

(10) *Use of Lights.*—Head lights may be used as far as R.V. From R.V. forwards side-lights and rear lights only will be used.

(11) *Action if Vehicles break down.*—2nd in command will inform O.C. by D.R.

(12) Return from reassembly point to camp will be by road Lonan (9005)—Ballabeg (9004). The same formations and order will be observed as on route from R.V. to Pt. 856.

Task for No. 1 *A.D.S.*—Pitch A.D.S. at road junction (884047). Treat wounded found there and the bearers will evacuate by hand carriage to road junction (882048), where they will load them on ambulance car which will evacuate them to Pt. 856, ambulance car returning to take second load. On completion of the exercise the A.D.S. and Bearer Section will move to reassembly point.

Task for No. 2 *A.D.S.*—No. 2 A.D.S. will enter field by gate in the west side of road 150 yards south of road junction (894054) and pitch A.D.S. The Bearer Section attached will collect wounded from the ground to the west of the A.D.S. On completion of the exercise No. 2 A.D.S., with Bearer Section, etc., will move to reassembly point.

Night Operation.—As this was the first night scheme for some years, it was made as simple as possible. The scheme was devised as a test for the transport section, and despite somewhat aged vehicles went through without a hitch and a high average speed of 12 m.p.h. was maintained. Side lights had to be used as the roads could not be kept free of civilian traffic.

The A.D.S. scheme proved most instructive, and the following points were noted for future guidance :—

(1) The necessity for personal reconnaissance; 1 mile to 1 inch ordnance maps, especially when they have not been recently revised, cannot be trusted in the matter of third-class roads and tracks.

(2) The ease with which an A.D.S. can be pitched on a dark, wet night without a light.

(3) The ease with which all lights inside the pitched A.D.S. could be screened from observation provided that the A.D.S. lorry was turned towards the front line. It has been our custom to face the lorries the other way round to make it easy to bring wounded in and to enable the section to make a quick getaway.

(4) The difficulty many find in correlating distance on the map and on the ground in the dark.

(5) When the O.C. in his car halts, the A.D.S. must also be halted. One A.D.S. left its O.C. far behind.

The following points have, as in the past, once more been noted during the recent Annual Training :—

(1) The necessity for lengthy reconnaissance of training areas and the

country around before annual training. This saves much time and ensures that the O.C., 2nd in Command, and Adjutant will have a few leisure hours in the fortnight.

(2) The average farmer and landowner appreciates a chat, and with a few kind words is willing to place his land and farmyards at the disposal of a medical unit.

In the future years, it is hoped that the responsibility for devising A.D.S. exercises will devolve entirely upon the Section Commanders, which will give more opportunity to the N.C.O.s in handling these sub-units. This will have the additional advantage of allowing time for the senior officers to devise exercises for the Field Ambulance as a whole, which will occupy the latter part of the camp.

As various articles in the Journal have shown, the training of Territorial Medical Units is at present exciting a certain amount of interest. It is not claimed that any new ideas have been introduced into this communication, but we do feel that the work which was carried out this year was of practical importance and had a definite significance in the training of the personnel of the Cavalry Field Ambulance, and it has been unnecessary to introduce extraneous exercises, interesting though they may be, which had little bearing on Field Ambulance duties and which it is highly improbable would ever have to be done on active service.

A SUGGESTION FOR MODIFICATION OF THE ADVANCED DRESSING STATION.

By Captain F. J. CLARK,
A.A.M.C. Reserve.

This suggestion for modification of the present type of advanced dressing station in certain types of warfare originated from the following considerations.

Modern warfare in sparsely settled countries, such as Australia, will rarely be of a stationary type. An invasion of such a country will lead to operations spread over a comparatively large area.

In such countries there are very few buildings of sufficient size to give the usual shelter and other conveniences required for dressing stations, and in mobile warfare some other means of establishing such services should be provided.

The present equipment of the Medical Services, although mechanized to some extent, does not appear to have kept pace with the changes in other arms of the forces. Therefore the Medical Services will be unable to maintain that efficiency and mobility which are essential if the principles laid down in Field Service Regulations are to be followed, i.e. "Advanced Dressing Stations are formed as far forward as operations permit and will always be in touch with R.A.P.s. They will be sited at localities accessible to ambulance transport, or, alternatively, served by tramway or trolley line and affording the greatest possible degree of protection. The number to be formed will depend on the circumstances of the action, but normally one, or at most two, Advanced Dressing Stations for each Main Dressing Station should suffice. In these circumstances the two companies of one Field Ambulance are sufficient to provide for the formation of the Advanced Dressing Stations and for the performance of the bearer work of carrying wounded from R.A.P.s to A.D.S. The remaining field ambulances will be retained in reserve." (F.S.R.s, 1930, Chap. 15, Sec. 116.)

In the circumstances of an action such as one visualizes in a country such as Australia, it must be further apparent that the maximum possible efficiency, combined with the maximum possible mobility in the forward Medical Services, will be necessary in order to conform with the statement that "The efficiency with which this system is organized and administered greatly affects the mobility and morale of the army." (F.S.R.s, 1930, Chap. 15, Sec. 112.)

Such necessity is still further emphasized by the fact that in certain situations the numbers of the defending forces would of necessity be

comparatively small, so that rapid and efficient treatment, administered as far forward as is deemed to be reasonably safe, seems eminently desirable.

Furthermore, in circumstances in which all units of the defending forces may have to cover considerable distances, whether in advance or retirement, if some scheme can be evolved whereby adequate shelter and services for wounded can be provided by the Medical Services with little or no aid from other units, such scheme has obvious advantages in conservation of labour and administrative effort.

The above considerations have been taken into account in formulating this proposed scheme, in which the writer believes maximum efficiency and maximum mobility are combined.

Regarding efficiency, the scheme aims at providing all the usual treatment offered in such stations, plus adequate means of resuscitation for the seriously wounded who may have to wait some time for evacuation, possibly over considerable distances, to the better equipped stations in the rear.

Regarding mobility, the aim has been so to concentrate and arrange the necessary equipment and shelter on one vehicle, that a minimum time would need to be spent either in preparing or in dismantling and packing it.

It is suggested that for the circumstances of mobile warfare the normal equipment of an advanced dressing station should be conveniently packed and readily accessible on one motor vehicle of special design. In addition to this, adequate shelter should be provided permanently attached to that vehicle and so arranged that the vehicle, from which equipment would only be removed as required, remains in the centre of the shelter.

Description of the Vehicle.

The vehicle required is either a thirty hundredweight or two ton truck chassis, preferably the latter, on which a special body is built.

The Walls.

The body resembles the ordinary van type commonly seen on such chassis except that the side walls consist of a series of shelves and drawers in which almost all the medical equipment (splints, dressings, instrument containers and the like) would be stored. These are accessible only from the outside by letting down the outer side of each wall to form a shelf. (This is illustrated in the plan showing the end view of the vehicle (fig. 1)).

This plan renders the ordinary dressing equipment of the station immediately accessible, as it can be used direct from the shelves. The sides of these "walls" of the body, when let down, may form tables on which material in use may be distributed.

In the plan showing the end view of the proposed vehicle two alterna-

tive types of shelves are shown. In that on the left hand the outer portion of the wall lets down to the horizontal position to form a table, while the shelves are fairly deep. On the right hand side the shelves are narrower and doubled so that the outer set let down through an angle of 180° and thus give a large area of access to small packages, etc.

These two types are merely suggested as possibilities, and no doubt the experienced A.D.S. medical officer will be able to decide which type is the better, or whether it would be an advantage to have one type on each side of the vehicle, or perhaps whether some better and more convenient arrangement could be devised.

Regarding the packing of dressing material, it is suggested that, in the type of mobile warfare anticipated, it would be advisable to alter the standard method of packing in panniers and to pack all such material in multiple small containers to be used only as occasion arose. The reason for this is that large containers, once opened, are immediately soiled, whereas the multiple small containers would ensure a constant supply of fresh dressings.

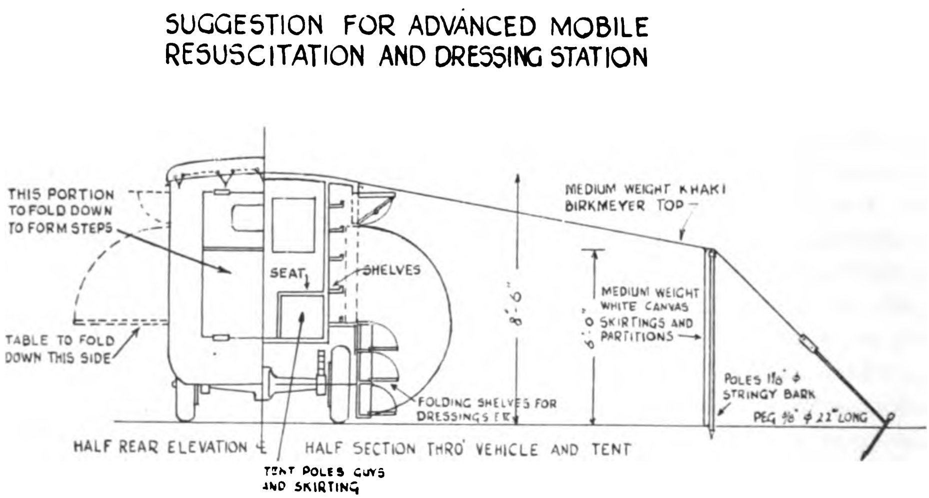


Fig. 1.

The Interior.

It is proposed that all bulky equipment should be carried in the interior of the vehicle. A special compartment is included in which the tent poles, guys and skirtings would be stowed, and the rear portion of this would provide a seat for two members of the crew of the vehicle (*see* fig. 1).

Description of the Shelter Arrangements.

The design of the shelter is the outcome of a long-cherished ambition on the part of the writer to possess such an equipment for camping

holidays, and the practicability of the suggested arrangement has been gone into very carefully.

As previously stated, the object is to retain the necessary stores in the centre of the shelter where they are in a convenient position and are only removed as required. Therefore the roof consists of a rectangular expanse of khaki Birkmeyer canvas which is attached permanently at its centre to the roof of the body of the vehicle. During transit this roof is folded on the top of the vehicle and covered with a loose cover lashed at its sides.

When a suitable site has been selected for the establishment of the advanced dressing station, the is roof unfolded to form a large rectangular

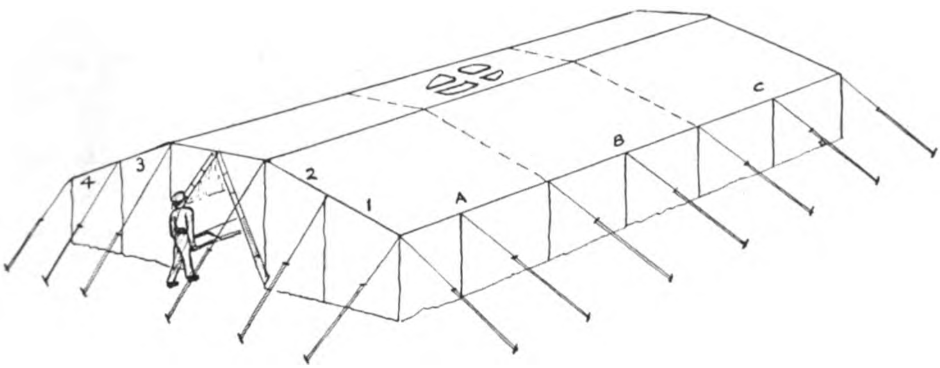


FIG. 2.

tent, supported by suitable poles and guy ropes as shown. The sides, and partitions if desired, are hooked on to this roof inside the poles and pegged to the ground. Entrance and exit are provided (*see* fig. 2).

Specifications of Shelter.

Material. Top: medium weight khaki Birkmeyer canvas. Sides and partitions: medium weight canvas (hooked on to top).

Size. Total ground area: 39 by 30 feet. Working area available: roughly 1,000 square feet.

Height: 8 feet 6 inches at the centre, 6 feet at sides.

Poles: Iron shod and iron bound at top. Steel pin in top which fits through handsewn eyelets in tent margin. Noose at upper end of guy rope fits over this.

	Pegs.
No. 14.—6 feet high	$\frac{3}{8}$ inch steel pegs.
No. 4.—8 feet 6 inches high	15 inches long.
No. 4.—7 feet high	No. 22.

Time Allowed for Erection.

Unfolding and erecting tent, hooking on sides and partitions (four trained men), thirty minutes; opening sides and rear of body, preparing material, fifteen minutes. Total forty-five minutes.

Time Allowed for Dismantling.

Pull down, fold sides and top, cover and lash, stow poles and guys, forty-five minutes; pack material, check quantities, close sides and rear, thirty minutes. Total seventy-five minutes.

METHOD OF USE.

It will be noticed that an entrance for wounded is proposed at the front end of the tent and an exit for those waiting evacuation at the rear. Both of these would be accessible to ambulance transport.

The walking wounded and the less serious lying cases would be treated on one side of the tent and the necessary materials obtained from the corresponding shelves. The seriously wounded and those requiring resuscitation would be treated on the other side and the necessary equipment obtained from that side of the vehicle. A trestle table would be arranged on this side on which wounded could receive attention, and it is suggested that extra trestles should be provided for the stretchers of wounded undergoing rechauffement. The seriously wounded, treated and waiting evacuation, would be placed at the rear of this side of the tent.

PROPOSED ADDITIONS TO THE USUAL TREATMENT.

In mobile warfare particularly, it is anticipated that a number of badly wounded would be seriously handicapped in their chances of recovery if some adequate means of providing resuscitation were not available at the A.D.S. It is therefore suggested that such stations should carry equipment which would provide for heating, intravenous infusion and possibly blood transfusion.

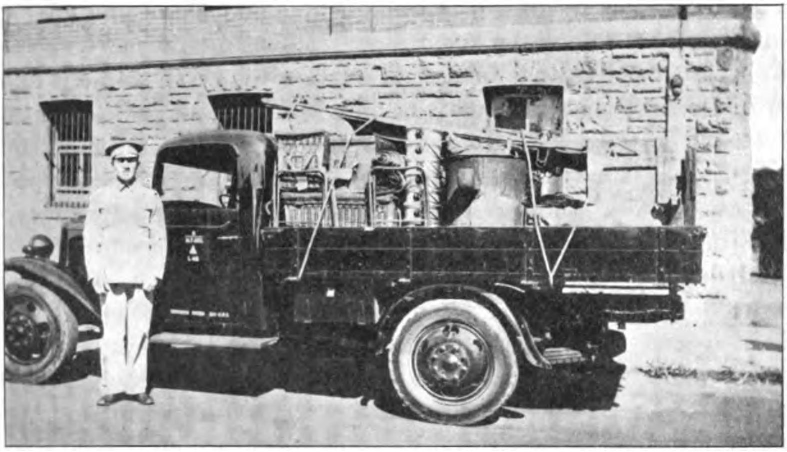
As stated by Lieutenant-Colonel Nicholls: "There are two schools of thought as to what exactly should be done at an A.D.S. and at different times both of them are right. If time and space permit . . . . Local conditions will decide which of these two methods of working the respective Dressing Stations will be more convenient" ("The Army Medical Services in War," T. B. Nicholls, 1937, p. 86, Sec. 14).

Surely, in the mobile warfare such as would be anticipated in Australia, it will be agreed that the functions of the A.D.S. can justifiably be expanded.

The addition of adequate resuscitation treatment would require:—

(1) Suitable heating devices for rechauffement.

(2) Suitable apparatus for intravenous infusion. It is suggested that six of these of simple type and twenty-four pints of gum saline, either in bottles or in ampoules ready for dilution with sterile water, should be carried.



Figs. 3 and 4.—Showing all existing A.D.S. equipment packed on one 30-cwt. lorry.

(3) Blood transfusion apparatus of simple type and means for typing donors from the walking wounded.

It is considered that the following personnel would be required for duty at such a Combined Mobile Advanced Dressing Station and Resuscitation Centre: 4 medical officers (one additional to those already allotted);

4 nursing orderlies; 2 waggon orderlies; 1 water duties; 2 sanitary duties; 1 cook; 1 A.S.C. driver (attached).

It is suggested that the normal crew of the proposed vehicle should consist of the medical officer, the driver and three or four nursing orderlies. These would be sufficient for the selection of the site and preparation of the station for the reception of wounded, while the remainder of the personnel would follow on by the ordinary means of transport.

The writer believes that in mobile warfare the establishment of such a station by the method described is at once feasible and practical and is an improvement on the accepted type in the circumstances anticipated.

At first sight it may seem impossible to carry the whole equipment of such a station and a number of the personnel on one vehicle of moderate size, but the accompanying photographs show the whole equipment of an advanced dressing station, both medical and ordnance, packed on an ordinary 30-cwt. truck (figs. 3 and 4). The arrangement of these in a vehicle of special design would therefore be extremely easy.

Furthermore, such a mobile station would be immediately available for the treatment of walking wounded, weather conditions permitting, wherever they might be encountered during its transit, because of the easy access to dressings, etc.

It will be noted that no provision has been mentioned for the treatment of cases which have been gassed. It is not anticipated that in the type of warfare for which this station is particularly designed these would be numerous and it is suggested that they should be treated in a separate tent provided from the field ambulance supply.

SUMMARY.

(1) A suggestion is made for the modification of the transport, structure and functions of an advanced dressing station.

(2) Both equipment and shelter for such a station are combined in a practical manner on one vehicle.

(3) Arrangements are made for this vehicle to carry a working crew which would be capable of carrying on until the remainder of the field ambulance company arrived.

(4) Because of the distances to be covered and the delays incidental thereto, the function of the proposed station is expanded to include resuscitation of the severely wounded.

(5) The necessity of extreme mobility of such a station has been stressed and this feature is the keynote of the above proposal.

(6) Some such arrangement as the above would, if adopted, bring the Medical Services in the forward areas into line with the modern methods of transport at present available to the other arms of the forces.

EXPERIMENTAL LOAD, CONVERTING THE CONTENTS OF THREE LIMBERED GENERAL SERVICE WAGONS TO ONE 30-CWT. MOTOR LORRY, IN FORMING AN ADVANCE DRESSING STATION.

CARRIED OUT DURING THE D.G.M.S.'S VISIT, 1938.

Serial No.	Nomenclature of articles	Numbers required	Approximate weights lb.	oz.
1	Bottles, water, medical	13	28	7
2	Cases, testing water (poisons) ..	1	6	—
3	,, ,, ,, (sterilization) ..	1	3	10
4	Companions, medical	1	15	—
5	Haversacks, shell dressing	9	25	14
6	Haversacks, surgical	3	21	12
7	Panniers, field fracture	1	88	—
8	Panniers, field medical	(pr.) 1	158	—
9	Panniers, surgical field	(pr.) 1	168	—
10	Splints, Thomas' Knee, without foot-pieces	5	20	5
11	Splints, metal sliding frame, foot-pieces for	5	2	8
12	Splints, pins, boot for	5	—	15
13	Arms extension, modified Thomas' Knee	3	5	4
	Additional Medical Equipment.			
14	Syringe, record, 10 cubic centimetres with 6 spare needles	1	—	8
15	War cases, empty	1	74	14
	Total weight, medical equipment		549	1
	Ordnance Equipment for Patients.			
	Blankets, G.S. (for patients) ..	50	214	4
	Sheets, ground ,, ,, ..	25	68	4
	Axes, felling, curved helve	1	5	9
	Boxes, stationery field, small ..	1	56	—
	Flags, directing, hospital pennants and poles, 5 ft.	2	3	—
	Implements, butcher sets in case complete	1	34	—
	Saucepans, F.S., nest of 8	(set) 1	22	—
	Kettles, camp, oval, 12 quart ..	8	78	—
	Stools, camp	4	22	8
	Stoves, Soyers	1	127	—
	Tables, camp, Mk. iii	1	18	8
	Lamps, operating, F.A. Mk. iv, with 18 lb. carbide	1	76	8
	Panniers, G.S. (*a*)	3	271	—
	Panniers, medical comforts	1	90	—
	Stoves, portable	1	94	—
	Jackets, sleeping	25	25	4
	Lamps, acetylene, with glass front and box	1	14	—
	Panniers, G.S. No. 4	1	54	—
	Panniers, medical comforts	1	90	—
	Trousers, pyjama	25	25	—
	Stretcher, ambulance	12	324	—
	Trestles, collapsible	(pr.) 1	25	—
	Rations for personnel and 50 patients	—	225	4
	Total ordnance equipment		1,964	1

	Ton	Cwt.	Qrt.
Total weight of medical and essential ordnance ..	1	2	1

Serial numbers 1-6 inclusive, and 10-13 inclusive are packed in No. 15. Panniers were empty on this occasion, the weights given above are when filled.

NOTES ON THE TREATMENT OF GONORRHŒA WITH THE SULPHONAMIDE GROUP OF DRUGS.

By Lieutenant-Colonel H. G. WINTER, M.C.,
Royal Army Medical Corps.

Ever since the introduction of the group of drugs containing the sulphonamide radical (NH_2SO_2) four years ago, a large number of products, all with the same, or very similar, formulæ, have been placed on the market.

These compounds immediately became fashionable and, in an incredibly short time a bewildering mass of literature on the subject flooded the medical journals throughout the world. It is with some reluctance, therefore, that I now add yet another article to the list: I am encouraged to do so, however, by the fact that my series of cases confirms the findings of O'Hanlon [1].

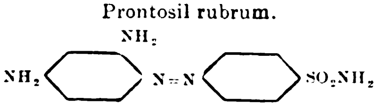
Treatment of gonorrhœa is notoriously unsatisfactory, and it is not surprising that venereologists, in the light of past experience with salvarsan and syphilis, should turn with hope to these new drugs; it is clear from the literature, moreover, that they represent a distinct advance in our armamentarium.

Even in the advertisements of manufacturers, which have now become almost official medical pronouncements, no agreement appears to have been arrived at as to correct dosage and type of case for which these drugs are best suited, etc.

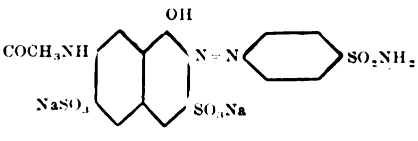
Assuming the value of this group in gonorrhœa therapy to have been proved, it was with a view to clarifying the situation by deciding the type of case best suited for such treatment and by fixing the optimum concentration of the drug required that, under instructions issued by the Director of Medical Services in India, a series of cases was so treated during the past year at Rawalpindi.

The major portion of the drugs used in these tests were supplied by the manufacturers for trial and were: Prontosil album (Bayer), sulphanilamide (Boots), proseptasine and soluseptasine (May and Baker), and also a new product not yet placed on the market—uleron (Bayer).

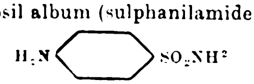
Prontosil rubrum.



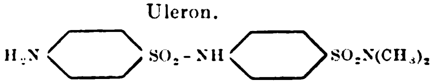
Prontosil soluble.



Prontosil album (sulphanilamide).



Uleron.



The chemical relationship of these drugs to one another is best indicated by reference to their constitutional and structural formulæ.

It will be seen that the simplest compound is prontosil album and that uleron is a di-sulphanilamide. Whereas the former drug was originally evolved to combat the streptococcus, the latter was produced in a similar effort to counter staphylococcic infections.

The active agent in all these products is undoubtedly the sulphonamide radical. In the body the drug is probably broken down to a simple benzene ring with the sulphonamide radical attached. It is not fully understood how this acts but it is probable that it is not in itself bactericidal but, rather, bacteriostatic. Whatever its action on bacteria may be, it is certainly a stimulant to phagocytosis.

In the series under reference, trials were made in all types of case and at various stages of the disease. Method of administration and dosage were varied. In some cases, no other treatment was given and in others the drug was combined with other forms of general or local therapy.

As recommended by Cokkinis [2], the daily dose was split and the drug administered several times a day, after and between meals and the last thing at night, in order to ensure constant concentration in the blood. Tablets were crushed and mixed with a small quantity of soda bicarb. and were given in at least half a pint of water. Eggs were excluded from the diet and glucose barley sugar was given during treatment. An alkaline mixture was given in addition to all cases, and patients were encouraged to drink large quantities of water and barley water. Saline aperients were withheld.

The amazingly rapid disappearance of gonococci from smears, the rapid amelioration of symptoms, including urethral discharge, and the rapid clearing of the urine which occurred in practically all cases, even when small doses only were given, points to the undoubted value of this treatment.

The simpler product, prontosil album, gave the best results. This was not unexpected in that its formula approximates most nearly to the supposedly active agent to which these drugs are reduced in the body. Uleron was disappointing; even in large doses, it failed to effect disappearance of gonococci from smears in acute cases for several days, and after the cases had "dried up," gonococci reappeared ten to fourteen days after stopping treatment. Results with this drug were, however, encouraging in patients who had had gonorrhœa previously, within the past three to four years, and those who had been under other forms of treatment for fifty days or over and also those which had relapsed after prontosil album treatment. Proseptasine was less toxic, but in my opinion, not so powerful, therapeutically, in the case of gonorrhœa.

Mild acute cases with no previous history of gonorrhœa and with little

or no general disturbance or local discomfort, did not react well, even to large doses of prontosil album. True, they appeared to clear up rapidly but they tended to relapse within twenty-one days—usually between the tenth and fourteenth of stopping treatment: such relapses were inclined to be resistant to further treatment. Some cases, of this type, moreover, evidenced very little reaction to the drug.

Severe acute cases with marked general and local symptoms and those with complications such as acute posterior urethritis, prostatitis, etc., and those who had had the disease for a fortnight or three weeks before commencing treatment did well, especially those who gave a previous history of gonorrhœa. In my series, I found that cases with secondary infection did not clear up so rapidly, and my results in this respect were not so good as those of Cokkinis [3].

To be of any value, the drug must be given in heroic doses and when so administered need only be given for three to four days. Not less than 5 grammes (10 tablets) a day are of any use. The daily amount should be split into four to six doses given at regular intervals throughout the day. It was found that cases which developed toxic symptoms cleared up rapidly even if only a small quantity of the drug had been given. Small doses—3 to 4 grammes a day or less—given over long periods only tended to render the disease chronic and very resistant to subsequent treatment. I believe that, to be effective, the drug must be pushed, for short periods, with rest intervals, to the limit short of serious toxæmia.

Local application is useless; parenteral administration of little value. The only method which gave satisfactory results was oral administration of large quantities spread over four to six doses throughout the day. The effect of the drug appeared to be enhanced by the addition of a small quantity of sodium bicarbonate to the dose. With large doses, a sulphur-free diet, plenty of bland fluids and prohibition of saline purgatives, only mild toxic effects, such as headache, diarrhœa, dizziness, mental dullness, erythematous rashes, etc., were noted; these rapidly disappeared on discontinuing the drug for twenty-four hours.

As regards collateral treatment, it was found better not to give any other treatment before commencing or during administration, with the exception of a simple alkaline mixture and the vaccine mentioned below, although irrigations during the rest intervals between courses and after conclusion of drug treatment were beneficial. Administration of vaccines before commencing drug treatment appeared to enhance the effect of the drug.

Conclusions.

Study of the literature reveals a similarity in the majority of articles published. Most lead off with an enthusiastic eulogium but end in an

anti-climax—certain cases do not react "according to Kocher." Various theories are put forward to account for these failures.

From observation of the reactions of cases treated and from careful analysis of results obtained, I have come to the conclusion that these drugs act only through the blood-stream and that they are not bactericidal but are bacteriostatic in that they reduce the defence of the invading bacteria to immunological processes. I agree with Cokkinis [3] that they do not stimulate the defence mechanism of the host, but I do assert that such defence must be at its strongest before optimum effect of the drug may be expected.

Cokkinis [3] suggests that some organisms are highly susceptible and that others are resistant to the action of the drug and, further, that this "sensitiveness" varies with the same strain of organism and in the same patient from time to time. It may be, and in fact it is probable, that certain organisms, and even certain strains of the same organism, are more susceptible to the action of the drug but, if the normal defence processes of the patient are not of a high order, good therapeutic results are not to be expected, and are not obtained. The body's defensive forces against the particular strain of invading bacterium must be fully mobilized.

Felke [4] referring to uleron, states that a "readiness to be cured" on the part of the sick body is an essential condition for rapid, and in many cases dramatic, cure and I am of opinion that this obtains also for other members of the group.

It is suggested that the failures reported are due to the fact that the body's reaction and resistance to the invading organism is at a low ebb and I am firmly of opinion that the drug should be withheld until the patient in relation to his disease is in an optimum condition to obtain full benefit from it. It is therefore further suggested that, in the case of gonorrhœa, the correct time for commencing treatment might be determined, with accuracy, by complement-deviation test—e.g. when the titre of the patient's serum was raised to its highest level. Investigation along these lines might well tend to show that those cases, frequently referred to in the literature, which do not respond to sulphonamide treatment are those in which body reaction has been poor or lacking.

In all cases, I now adhere to the following lines of treatment with which I have had excellent results :—

Prontosil album only is used in the following doses in all cases :—

Two tablets of 0·5 gramme each at regular intervals between and after meals, six or seven times a day (12 to 14 tablets = 6 to 7 grammes) for four days ; rest four days ; further course for four days, if necessary. In a large number of cases only one course is required—maximum, 56 tablets (28 grammes). If, however, after four days' rest, the urethral discharge

still shows a large number of pus cells, a second course is indicated. It is rarely necessary to give a third.

Mild toxic symptoms are to be expected but are not of great consequence. If they become more severe, the drug is withheld for one day, after which the symptoms have usually disappeared and the course is completed with slightly lower doses—2 tablets of 0·5 gramme five times a day (10 tablets = 5 grammes).

Mild cases with little or no reaction are put to bed on a fluid diet with barley water *ad lib.* and an alkaline sedative mixture; they are given two or three doses of vaccine—either Woolwich polyvalent exotoxin, arthrigon or compligon. When it is considered that the bodily resistance to the disease has been raised—usually in from ten to fourteen days—prontosil album treatment is commenced.

In severe cases in which general and local reaction is marked, especially those with acute complications, in chronic and long-standing cases and in those cases with a previous and fairly recent history of gonorrhœa, prontosil album treatment is commenced immediately.

During the rest intervals and after ceasing treatment, if a gleet persists, anterior and posterior irrigations with potassium permanganate, 1 : 20,000, twice daily at first, reduced to once daily, is indicated. A few chronic cases may also require irrigations with hydrarg. oxycyanide, 1 : 8,000, or zinc sulphate, 1 : 4,000, twice a day for two days only, in place of potassium permanganate.

In cases which have relapsed after prontosil album, I have found uleron, in the same doses, of value.

I am of opinion that the strictures as regards diet, ingestion of fluids, saline purgatives, etc., should be rigorously adhered to during treatment with these drugs.

My thanks are due to Colonel F. F. Strother Smith, I.M.S., A.D.M.S., Rawalpindi District, for permission to send these notes for publication and I am indebted to Sjt. R. Elbrow, R.A.M.C., for his valuable assistance with the cases and for collection and compilation of notes.

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STATISTICS.

OBSERVATION OF FIFTY CASES TREATED. ALL FIGURES ARE WORKED OUT ON AVERAGE.

	Number of cases	Drug used	Amount of drug *per diem*, in grammes	Total amount of drug used per case—0·5 grm. tablets	Preliminary treatment	Day of disease on which the drug was commenced	Number of days taken to effect cure from the date of commencing the drug	Total number of days under treatment from date of onset of the disease to cure	Number of cases which relapsed	Remarks
	2	3	4	5	6	7	8	9	10	11
1	2	Prontosil alb.	3	63	—	5	66	71	1	Relapsed twice
2	2	,,	3	128	Intra-urethral 10 per cent P. alb.	2	49	51	—	
3	1	,,	—	—	,,	3	40	43	—	No apparent effect on disease
4	2	Proseptasine and Soluseptasine	4 10 c.c.	30 30 c.c.	—	4	38	62	1	
5	5	Uleron	3	48	Routine	68*	18	86	—	*One case commenced on 160th day
6	7	Prontosil alb.	4	62	,,	30	15	45	1†	†Peri-urethral abscess
7	4	Sulphanilamide	4	64	,,	5	30	35	1	
8	1	,,	5	80	—	13	18	31	—	Gonococci re-appeared after stopping drug in about half the cases
9	9	Uleron	4	54	Routine	14	20	34	1	
10	1	Sulphanilamide	2½	80	,,	240	70	?	—	A chronic case in an Indian. Cure doubtful
11	4	Uleron	5	75	—	13	24	37	—	Gonococci re-appeared after stopping drug in three cases
12	1	,,	5	60	Routine	3	56	59	—	
13	1	Prontosil alb.	6	36	—	2	12	14	1	
14	1	,,	6	84	Vaccine	95	14	109	—	
15	9	,,	6-7	52	Vaccine	19	7	26	—	

Notes :—

1. The figures illustrate—
   (*a*) Small doses not effective.
   (*b*) Drug given early in the disease not effective.
2. Uleron is not so effective as the other members of the group.
3. The best and most consistent results were obtained by giving 6 to 7 grammes a day of prontosil album for four days after three weeks' preliminary vaccine treatment and no irrigations. This method is now adhered to as routine.

MARGARINE.

By Colonel K. COMYN.

Margarine owes its origin to war—Napoleon III offered a reward during the Siege of Paris in 1870 to anyone who could find a substitute for butter. Mouries invented this commodity, and shortly afterwards the families of Jurgens and van den Berghs commenced production in Holland on a commercial scale.

Margarine has now become one of the most universal and constant items of the soldier's diet. Data culled from the messing books of various units show that the average consumption per man per day is 1½ ounces.

The fact that it has been arranged to vitaminize several brands of margarine as supplied to the N.A.A.F.I., without increasing the retail cost, has added considerably to the value of margarine as a food. It has long been a matter of controversy whether the soldier's daily diet gives him sufficient vitamins. Considerable stress has often been laid upon the provision of green vegetables, tomatoes, salad, etc., in order to provide vitamin C. But what of vitamins A and D? It has been presumed that there is sufficient of these in his ration of meat, bread, potatoes, bacon and cheese—and in summer months his outdoor life and sunshine enable him to produce sufficient vitamin D for his needs; but the soldier's food is always subjected to prolonged cooking which is deleterious to the vitamin content. To what extent the vitamin A is destroyed by this cooking cannot yet be measured. It seems possible, if not probable, that during the winter months the soldier's daily diet is deficient in vitamins A and D. It seems possible also that this condition of avitaminosis may play a part in the incidence of such diseases as tonsillitis and inflammation of areolar tissue, which includes many cases of boils, septic sores and abrasions so often associated with being "run down." These two groups of diseases cause a very large proportion of the sick wastage in Army life, especially in young soldiers.

The value of margarine as a vehicle for the addition of vitamins A and D to the soldier's food does not appear to have been sufficiently recognized—the factors which determine its value are (i) its universal daily use, (ii) its use in the raw state, only occasionally being used for cooking, (iii) its use within the maximum period of three weeks from manufacture.

Perhaps a brief description of the composition and method of manufacture of margarine may be of interest.

Composition.

Taking an average from several brands:—

Protein	0·2 per cent.
Fat	84·8 ,,
Salt	2·0 ,,
Water	13·0 ,,

The protein is derived from added milk; the fat is derived principally from vegetable oils. The salt has to be added during the process of manufacture.

Several Acts of Parliament have been passed governing the manufacture, sale and distribution of margarine, but these have now been covered by a Consolidation Act—"The Food and Drugs (Adulteration) Act 1928." The principal points of this Act are that margarine shall not contain more than 16 per cent water, or 10 per cent butter, and be free from preservative, other than common salt. (This provision does not apply to margarine consumed outside the United Kingdom.) There are also several regulations regarding the branding of the word MARGARINE on the boxes, and on any wrapper in which it is enclosed.

The War Office has a contract standard laid down in the Handbook of Specifications for Supplies, 1930. The principal details of this specification are that the margarine must not contain more than 16 per cent of water, not more than 3 per cent salt, and be free from preservative. In the case of margarine for hot climates, the melting point of the fat shall not be less than 31° C. nor more than 35° C., as determined by the cooling curve method. This quality is packed in hermetically sealed 2 lb. tins.

Food Value.

The food value, apart from any added vitamin, depends entirely upon that of the fat or vegetable-oil content, the protein being negligible. The vitamin content in the vegetable oil is nil, and that of added milk or animal fat so slight as to be negligible.

The caloric value of the vegetable oil is high. The average of a number of samples according to Professor Plimmer's tables is 3,579 calories per pound, so that 1½ ounces of margarine will provide the soldier with approximately 335 calories, or one-twelfth his total daily requirement, at a cost of less than ½d.

Keeping Quality.

If kept under ordinary conditions of coolness (under 12° C. recommended) and cleanliness margarine will remain fresh and suitable for use for three weeks. It will keep longer, but prolonged keeping is not recommended. The manufacturers will guarantee the keeping qualities up to six months if this is specially stipulated in the contract, but that would necessitate a special quality and special packing in sealed tins as is done for margarine sent abroad.

Manufacture.

The process of manufacture may be conveniently divided into various stages for descriptive purposes:—

(1) *The Production of the Vegetable Oil.*—The oils used in manufacture are all of vegetable origin obtained by crushing the seeds of many plants.

The more commonly used are groundnut, cotton seed and soya bean. There are very few plant seeds from which the expressed oil cannot be utilized. In a few cases some poisonous or toxic substance prohibits their use.

The oil is expressed in factories at Selby, Liverpool and other towns in the north, and the crude oil is transported in tank waggons to the margarine factory at Purfleet.

(2) *Refining the Oils.*—The crude oils after expression always contain some impurities which are undesirable, and which have to be removed. For example, fatty acids impart undesirable tastes or odours, and colouring matters cause variations in the appearance of the finished article.

The oils are subjected to processes of neutralization to remove fatty acids, bleached with charcoal or bleaching earth to remove colouring matters and some other bodies that are not pure fat, and distilled to remove volatile substances. The pure oil thus produced is pressed through filters made of cotton cloth and filter paper. When finished, the oils and fats are odourless, colourless and tasteless.

(3) *Blending of Oils.*—The various oils are put into large tanks which are heated to a temperature which will keep the oil liquid. The melting points of the different oils vary considerably. This materially affects the condition of solidity or stability of the finished article. It is essential that the margarine should have a definite stability and known melting point, not only from the point of view of marketing and keeping quality, but also that of digestibility. The digestibility depends considerably on the state of solidity and melting point. To this end the requisite quantities of the different oils are run into the blending vats to give the correct mixture which will give a product with a definite and constant melting point, not too high to cause indigestibility nor too low to render it soft in warm weather, and to give a digestibility equal to butter.

The proportions of the different kinds of oil necessary for blending are known, so that it is unnecessary to test each churn or mixing for melting point or to work out proportions in each particular case.

(4) *Proportion of Milk.*—The milk used at Purfleet is pasteurized liquid milk. Samples of this milk are tested bacteriologically every day. It is again pasteurized by the flash method at 190° F.

The object of milk-blending is chiefly to impart the required flavour to the margarine; it is not intended to increase or alter in any way the food values. To acquire the flavour that is necessary the milk has to be "ripened." This is done by adding standard bacterial cultures of lactic acid and other allied bacilli, and incubating the bulk of the milk in large vats in which rotating paddles keep the milk in constant motion. The temperature during this process is maintained at 18° to 28° C., and the process continued for a period of eight to twenty hours varying with

the activity of the bacterial action. The milk is tested periodically during this time for the amount of lactic acid formed, and when this is found sufficient, the ripening process is stopped by cooling off.

(5) *Churning.*—The two chief constituents are now ready to be blended for the final processes. The refined oil mixture and the ripened milk are run from their respective vats or tanks through pipes into the mixing vats, where, by constant stirring with revolving paddles, a homogeneous emulsion is made. During this process the requisite amount of colouring matter is added. This colouring matter is one of the soluble coal tar derivative dyes permitted by the Ministry of Health, and which is very constant in imparting the same colour to the finished product. The proportion of milk blended with the oil varies from 10 per cent to 30 per cent, the variation depending mainly upon the quality of the margarine and upon the flavour required.

The temperature of the mixture in the vat during mixing and churning is kept at a few degrees above the melting point of the oil or fat. The process of mixing, blending or churning is continued for about thirty minutes.

(6) *Addition of Vitamins.*—In the better brands of margarine vitamins A and D are added in the form of standard concentrates, which are obtained from sources rich in these accessory factors. They are added during the churning or mixing process.

The presence of vitamins in these brands is subsequently proved by testing samples just before packing. These tests are chemical (Carr and Price modified by Anderson and Nightingale), physical (ultra-violet rays) and animal feeding.

(7) *Cooling and Kneading.*—Up to this stage in the manufacture the oil or fat mixture has been maintained at a temperature a little above its melting point to prevent solidification, and the final milk blended, vitaminized, coloured and thoroughly churned mixture has now to be cooled and solidified into the final product which is recognized as margarine. If the emulsified mixture is allowed to cool slowly, there is a tendency to crystallization of some of the constituents, similar in appearance to that observed when butter is melted and then cooled slowly. To prevent this effect, the emulsion on completion of the churning process is rapidly cooled. Cooling is started in the churning vat by adding cubes of ice which are made in an adjoining section of the factory. The emulsion, while still liquid, is then run by pipes to large metal rollers, on to which it is poured from fine jets forming a thin layer on the metal surface. The rollers are cooled to a temperature of $-15°$ C. by the evaporation of liquid ammonia circulating through them. The layer of emulsion is rapidly solidified into a homogeneous film. This film on the rollers is approximately $1\frac{1}{2}$ millimetres thick. It is scraped off by a knife edge abutting on

the under surface of the roller and is deposited in large aluminium trucks which are run underneath the cooling machine. This machine cools four tons per hour, each truck taking approximately twenty minutes to fill.

After the margarine has been mixed or churned, rapidly cooled and scraped off the cooling rollers, it is still in a somewhat brittle or friable condition, which is unsuitable for ordinary use. In order to impart to it a more cohesive or spreadable character it has to be kneaded. This is done by passing it between closely applied revolving rollers, set in pairs, revolving in an inward direction towards each other, so that the margarine deposited on them from above is rapidly carried through between the roller surfaces. The gap between the rollers varies according to the quality of margarine being manufactured at the time. The average gap is ¼ inch. There are three pairs of rollers through which margarine passes consecutively. From beneath each pair of rollers it is conveyed to the top of the next pair on a travelling belt made of a special composition of rubber and canvas. From beneath the third pair of rollers it is deposited into large collecting bins.

During the process of kneading the requisite amount of salt is added Samples are tested just before the kneading for salt content and water content. The salt content is invariably below 3 per cent, and salt is added as required, the kneading process ensuring an even distribution throughout. The water content is usually round about 12 to 13 per cent varying chiefly with the amount of milk blended in and the amount of kneading that has taken place during the manufacture.

The margarine is now finished and ready for weighing and packing.

The varieties of margarine differ mainly in the quality of the fats and oils used and also in the flavour imparted by milk blending and in the food value of added vitamins.

My thanks are due to Mr. Anderson of the Technical Department, and to Mr. Euren of the Sales Department, of Messrs. Unilever, Ltd., for their courtesy and patience in describing the details of manufacture.

Editorial.

NOTES ON CANCER.

THE mortality from cancer appears to be slowly increasing. The crude death-rate in 1936 was 1,625 for both sexes per million living, the rate for males being 1,612 per million and for females 1,636. The rate in the period 1901-05 was 867, and in 1937, 1633; the rate now is twice that at the beginning of this period.

Nearly half the cancer deaths (48 per cent) occur in persons under 65 years of age. During the working period of life, from 15 to 65 years of age, 17 per cent of all the deaths which occur are attributable to cancer.

Most investigators are now agreed that the recorded increase in mortality does not necessarily mean augmentation of general constitutional factors. The rising rates, however, do increase the seriousness of the administrative problem of provision of adequate means for diagnosis and treatment.

In the text volume of the Registrar-General's Review a table of standardized mortality rates for individual organs appears for the most important sites for each sex. From this table it appears that in accessible organs, such as the lips, tongue, jaw, uterus and skin, while the rates have fallen considerably between the earliest and latest periods, they have remained practically stationary, with a tendency to fall, in the last five years. In these accessible sites in which increasing accuracy of diagnosis has played only a small part, the falls are probably due to a combination of diminished frequency and the effect of treatment. Another group consisting of the stomach, intestine, rectum, lung, pancreas and prostate shows a marked rise over the longer period and a tendency to rise over the shorter period. On the rates for such organs treatment can have little effect and the rises are due to increased incidence combined with more accurate diagnosis, or both. Experience suggests that improved diagnosis is the more important. This receives support from the fact that in an intermediately placed group, the pharynx and œsophagus, where the influence of diagnostic and therapeutic changes is small, the changes in the rates are small suggesting that changes in incidence are also small.

Investigation into the cause of cancer through laboratory research continues with increasing vigour, and details of the various experiments are given in the Report of the British Empire Cancer Campaign, and in the report by Dr. Gye of the work carried out by means of the Imperial Cancer Research Fund.

Research work is also being carried on at the Royal Cancer Hospital, the Middlesex Hospital, cancer research laboratories and other large

hospitals in London. In the provinces, there are centres at Sheffield, Leeds, Newcastle, Birmingham and Manchester. The Medical Research Council's investigations extend to research in all medical problems including cancer.

In less than a lifetime both knowledge and treatment in regard to tumours have improved out of recognition. It is only within the last few years that operations for cancer have been based on a precise knowledge of the spread of the disease. The causes of cancer yet remain obscure; but there is no doubt about certain of the causes, viz. the synthetic preparations. The study of growth stimulating and growth inhibiting substances seems likely to be a profitable field of research.

The major part of research has been directed fairly closely into two main channels: those connected with carcinogenic substances, and those initiated by the discovery of virus tumours in fowls.

In 1935 Dr. M. des Ligueris of South Africa reported that he had succeeded in inducing a malignant transformation in tissue cultures of normal chicken fibroblasts by adding a small amount of dibenzanthracene to the culture medium in which the cells were growing. Inoculation of chickens with these cultures resulted in the production of rapidly growing sarcomata from which after a number of serial transplantations a filtrable virus could be extracted. Immunological experiments with the des Ligueris sarcoma have shown that it is closely related to Rous sarcoma No. 1, and perhaps more closely to the Fujinami tumour, being like it communicable to ducks.

It has been found that if the Rous sarcoma agent is present in the body of a fowl it may pass to a chemically-induced tumour present at the same time. It has further been found that the Rous virus will pass not only from the Rous tumour to other tumours of chemically-induced type but also to the normal tissues. Extracts of many organs and tissues of fowls bearing the Rous sarcoma will produce new tumours when injected into fowls. These organs and tissues are free from sarcomatous growths, although rich in the sarcoma-producing agent.

Recent syntheses of derivatives of 1 : 2 benzanthracene has led to an increase in our knowledge of the types of substitution which lead to cancer-producing activity in the benzanthracene hydrocarbons. In this connexion it is of interest that 9 : 10 dimethyl—1 : 2 benzanthracene has proved to be the most rapidly acting chemical cancer-producing agent yet found as tested by capacity to produce cancer of the skin.

Many hydrocarbons known to be carcinogenic have been found to exert an inhibitory effect on cellular proliferation. It is suggested that these substances act by producing a prolonged retardation in the growth of the affected normal cells which eventually react by the production of a new cell type with permanently lowered differentiation and a correspondingly

increased fission rate. In this view the cancer cell is supposed to be a somatic variant developing in adaptation to protracted inhibition. The view is supported by the relative resistance of chemically-induced tumours to the inhibitory action of the carcinogenic hydrocarbons.

Work on the action of carcinogenic compounds on the growth rate of spontaneous tumours of the mouse has confirmed the inhibiting effect of parenteral administration 1 : 2 : 5 : 6—dibenzanthracene, which has been accompanied by partial regression in some 18 per cent of cases.

In the induction of epitheliomata, carcinogenic substances act not only on the epithelium which ultimately supplies the tumour cells, but also on the deeper tissues. The ultimate effect may be due to impairment of the nutrition of the epithelial cells.

Extracts of certain tissues exert an accelerating effect on the growth of chick fibroblasts *in vitro*, whereas extracts of other organs have no such action. Extracts of brain are more active in this respect than extracts of embryonic or other tissues. The growth-promoting power evidently does not depend on the rate of growth of the tissues from which the extract is obtained, but the tissues which are most active possess the most active powers of anaerobic glycolysis. The energy for growth seems to be in some way connected with the change from glucose to lactic acid.

It has been disputed whether cancer spreads within lymphatic channels as small emboli or by permeation. This question seems to have been settled by injections carried out with Thorotrast injection methods. These show that cancer spreads by means of minute emboli which are carried along the lymphatic channels and are arrested in the lymphatic glands. Thorotrast injections have shown the vessels to be patent, and certainly not permeated with cancer cells.

An investigation of the relationship between histological appearance and prognosis has shown that in the case of mammary cancer the presence or absence of axillary metastasis is the most important single factor in prognosis. Histological grading is of value when combined with the results of examination of the lymphatic glands. In a series of 172 patients only 19 per cent survived for ten years, but of the patients with Grade I tumours and no axillary metastases 57 per cent survived for this period. Age has little effect on the prognosis.

Reporting on the work of the Imperial Cancer Research Fund, Dr. Gye points out that the work in the laboratory at Mill Hill confirms observations made elsewhere.

In the Section on Carcinogenesis there is a renewed warning of the dangers of using Thorotrast in radiography. The substance appears to remain in the body indefinitely, and Dr. Foulds has produced both sarcoma and carcinoma at the site of its injection into guinea-pigs.

Though no cancers have yet appeared in human beings, it is considered premature to assume that Thorotrast is harmless, especially as bone tumours appear in workers who handle luminous paints.

Tar and carcinogenic hydrocarbons evoke squamous epithelioma when applied to the skin, or sarcoma when injected beneath it. The carcinoma produced by Dr. Foulds in the guinea-pig is apparently the first example of a glandular cancer produced by the local action of a carcinogenic agent.

Rous showed that if a rabbit's ear was painted with tar and Shope's papilloma virus was then injected intravenously it would be localized in the tarred skin and produce growths which from the first were malignant. Andrewes, Ahilström, Foulds and Gye have tried to produce connective tissue tumours in the same way. Tar was injected intramuscularly and the Shope virus intravenously, and in each laboratory one rabbit of a small series developed a sarcoma at the site where the tar had been injected; the usual effect was a fibroma at the site of injection and a general fibromatosis. Dr. Foulds found that the essential factor was the immediate tissue reaction to the tar, and not the presence of tissue which had been long in contact with tar and might be in a precancerous state. The conversion of fibroma to sarcoma was not again observed, and when Andrewes and Ahilström examined their sarcoma they could find no trace of virus in it.

In America it is reported that if 1 : 2 : 5 : 6—benzanthracene is repeatedly injected into rabbits they become much better media for the growth of transplanted Brown-Pearce rabbit carcinoma. It is suggested that substances containing the phenanthrene ring alter the tissues and make them more susceptible to tumour growth.

In New York Woglom discovered that subcutaneous abscesses arising as a complication of experiments with a rat tumour could be serially transmitted by a filtrable agent. Dr. Knox found this agent had an average diameter of about 0·2 micron. The interesting fact is that the virus is found as a contamination of a tumour and is pyogenic.

Dr. W. Cramer and Mr. Hornung, continuing their work on hormones, conclude that there may be a physiological antagonism between oestrone and the hormones secreted by the pituitary acidophil cells. Experiments on mice have shown that the thyrotropic hormone which stops the action of oestrone on the pituitary body and on the mammary gland also prevents in a specially selected strain of mice the spontaneous development of breast cancer.

Strong, of Yale, has found that the inclusion of heptylaldehyde in the diet of mice with mammary cancer causes extensive liquefaction of the tumours, and sometimes complete regression. The heptylaldehyde appears to act on the connective tissue framework of the tumours, and when it was applied to mixed cultures of fowl tumour cells and chick

fibroblasts no selective action on the growth of the cancer cells could be demonstrated.

The last section of Dr. Gye's report is concerned with radiation. It has been found that the glycolytic process used by the cancer cell is specificially vulnerable to radiation applied at low temperature. It is stated that experiments give no evidence of any dependence of biological effect on the quality of the radiation used. A given dose of radiation measured in rantigen units, whether gamma, beta or X radiation, produces exactly the same inhibition of retinal glycolysis.

In the Report on Radium Beam Therapy Research issued by the Medical Research Council in 1938, it is stated that the research in 1934-38 was limited to cases of cancer of the mouth, pharynx and larynx, as growths in these are situated in sites accessible to direct examination. From the beginning it was realized that the problem of successfully treating cancer is as much a physical as a clinical one, and a physicist and his staff have been in co-operation with the clinicians.

Stringent rules were drawn up to avoid undesirable effects on the workers and the patient from undue radiation. Charged condensers carried by each member of the nursing staff recorded the amount of radiation received by every nurse each day. There was no single case of damage by radiation to any member of the nursing staff or any of the research staff, and no accidental damage to any patient.

In the past a cause of failure in radium beam therapy has been the inability to assess with accuracy the dose delivered to tissues at some distance from the surface. A great deal of thought and work have been expended in the control and estimation of dosage. Blood examinations in both staff and patients were made at regular intervals and recorded. Every case was followed up and not a single patient was lost sight of.

An attempt was made to treat the primary growth through the lymphatic gland area, so that both might be influenced at the same time.

In many cases the enlarged glands disappeared and did not return. This was very encouraging, as the surgical treatment of infected glands in the neck is extremely difficult in carcinoma of the mouth.

The following conclusions were drawn as to the value of the treatment:—

(1) In cases where the growth is early and localized its complete disappearance can be expected.

(2) Where there is secondary involvement of the lymphatic glands in close proximity to the growth, the enlargement of the glands can also be made to disappear.

(3) Where both the primary growth and glands are in an advanced and inoperable stage, in a small proportion of patients the disease can be

made to disappear, and in a large proportion distressing symptoms may be relieved.

(4) When distant metastases have already developed, their growth will be progressive and inevitable, even though in the region treated the disease has been destroyed.

(5) Though it is too early to make definite pronouncements, it would appear that treatment of cancer of the mouth and throat by radium is at least as satisfactory as that provided by surgery or by interstitial radium therapy. It has, further, the great advantage that the results are obtained without mutilation of the patient.

The research staff are now making plans for investigating the treatment of carcinoma of the breast and of the mouth by means of a unit containing ten grammes of radium, which has never been attempted in this country. It will be of great interest to compare the results obtained with a ten-gramme unit with those obtained with a five-gramme unit hitherto used: the dosage will be doubled, the treatment time approximately halved and the biological response may be improved.

Another valuable investigation, plans for which are being made, would be a parallel trial of treatment with X-rays, done with the same accuracy and care as have been given to the radium work, in order to provide a basis for an unbiased comparison of the relative merits of the two methods.

In the Report of the Medical Research Council for 1937-38, just issued, it is stated that there is already looming in the distance the need for studying the therapeutic effects of neutrons and of temporarily radio-active substances, such as radio-sodium, now made possible by the discovery and development of the cyclotron by Lawrence in California. The earlier reports from the University of Berkeley indicate that the biological effects of neutrons are of even greater interest than those of X-rays and gamma rays; and it may be that in the special case of cancerous growth, and allied conditions, neutrons may be of outstanding importance. There is even the possibility that both radium and X-rays will be superseded by the cyclotron in the treatment of cancer by radiations and radio-active substances.

The Council state that Dr. F. G. Spear of their staff is at present in California working with Professor Lawrence on the biological effects of neutrons.

In assessing the facilities for treatment of cancer, the Chief Medical Officer of the Ministry of Health in his report for 1936 points out that it is important to find out the probable number of cases requiring treatment. It is comparatively easy to anticipate the number of cancer deaths as well as their distribution by organs which will occur in a given administrative

area within one or two years. It is next important also to know to what extent the number of deaths form a reliable guide in assessing the actual patients to be cared for. In the case of cancer of the breast the "natural duration"—in the absence of treatment—is about three years; there will, therefore be three times as many persons suffering from the disease as succumb to it in that year. A similar basis is used for the "accessible" group of organs for which data relating to the natural duration have been acquired; while for the remaining organs a duration of one year is assumed, an incontrovertible minimum. The estimation obtained in this way is a rough one; the effect is to indicate that the number of patients during a given year is 50 per cent higher than the number of deaths recorded for that year. In estimating the number of patients for whom full facilities for treatment are needed, cancer cases may be classed into two groups, (*a*) those in accessible sites and (*b*) those in internal organs. The number of cases in group (*a*), the treatable group, is in the region of 40 per cent of the total number of patients; the estimations just mentioned have been used in determining the adequacy of present facilities for treatment.

From the returns of a number of hospitals the proportion which cancer patients form of the total numbers admitted can be ascertained. It was found that cancer patients formed about 6 per cent in the hospitals with full facilities for treatment and about 2 per cent in the smaller provincial hospitals with no facilities other than operative treatment. Separate enquiries were made at those hospitals devoted entirely to the treatment of cancer and at those large general hospitals partially equipped for radium treatment. The actual numbers could be obtained for the former, but in the case of the latter it was necessary to take figures half-way between those having full radiation treatment and those with none at all. Of the actual cases so estimated it was ascertained that about, or rather less, than 40 per cent belonged to the treatable class.

The figures obtained for all the hospitals were then set against the total number of cancer cases of treatable sites estimated to be in existence during a year. The first deduction made from the figures was that the total number of cancer patients admitted to voluntary hospitals is about two-thirds of the total number of deaths, so that if the number of cancer patients is about 50 per cent higher than the deaths, not more than 40 to 50 per cent of all cancer patients are admitted. For the whole country it would appear that not more than a quarter or a third of all treatable cases are admitted to hospitals in possession of full means for radium treatment.

In order to remedy this state of affairs the Minister of Health feels satisfied—and in this he is supported by the views of the Radium Commission—that the position can only be met by a more active co-operation of local authorities. There should be complete co-ordination between the work of the voluntary hospitals and the local authorities. Treatment

would remain with and be carried out in the hospitals, the centres of X-ray and radium work, while the "field" work would rest with the local authorities. They would be concerned with advice outside the centres (with the help of the staff of the centres), with informing practitioners and the public, of the arrangements for helping and inducing patients to seek advice and treatment, with after-care and "following up." A number of local authorities are now practising one or other of these forms of co-operation, with results so favourable as to encourage their wider application.

In the matter of advice to the public, it is important that the notice of the provision of additional facilities should be in such a way as to encourage patients to seek early treatment. As regards obtaining treatment earlier the British Cancer Campaign through its Central Propaganda Committee is doing work devoted to this particular object.

The Radium Commission stated in their Seventh Annual Report that the facilities for treatment were inadequate, and as the estimates made by the Ministry corroborated this view it was deemed well to attempt a more direct assessment of the situation. Accordingly, an inquiry into the extent to which cancer patients receive treatment was made in 1938 by the Hon. Sholto Douglas for the Ministry of Health, and the results were published by the Ministry in Report 39 on Public Health and Medical Subjects, in December, 1938.

The report shows that patients with cancer can be divided into three groups. The first contains those patients who suffer from the disease in organs for which, under present conditions, treatment is impracticable, e.g., pancreas, œsophagus, lung, bronchus, etc. Such patients form about one sixth of the total cancer patients, and although a sensible proportion attend for advice at hospitals, little or nothing can be done for their relief.

The next group includes patients for whom treatment may be possible, provided they attend at an early stage and adequate facilities for treatment are available. This group comprises over half the total cancer patients, most of whom are affected in the stomach and intestinal canal. About half the patients attend for advice, but only about one tenth obtain any form of radical treatment.

The third group includes patients with cancer of those organs, viz. breast, uterus, skin, tongue and mouth parts, which are amenable to treatment by surgery and/or radiation at almost any stage of the disease, and constitutes one quarter of the total deaths from cancer. Nearly three quarters attend for advice at voluntary hospitals, and over half obtain treatment, but the proportion which attends for treatment at hospitals equipped with full facilities for modern treatment is small and just over one quarter.

Clinical and other Notes.

A CASE OF OLD DISLOCATION OF THE SEMILUNAR BONE TREATED BY OPEN OPERATION.

By Major Alec McMillan.
Royal Army Medical Corps.

The patient, a female, aged 32, was injured in a riding accident on October 30, 1937. She was thrown from her horse, and fell on the dorsum of the right hand and forearm.

I saw her for the first time on December 6. Her wrist was then very swollen, all movements being limited and painful. Radiographs showed an anterior dislocation of the semilunar bone with rotation. On December 9 an attempt was made by manual traction under an anæsthetic to effect reduction. The method described by Böhler [1] was adopted, and strong traction in the long axis of the limb was made continuously for twenty minutes. The dislocation persisted, and a radiograph showed no change in the position of the bone.

Arrangements were made for the admission of the patient to hospital for an open operation. On December 13 under ether anæsthesia an incision four inches long was made along the ulnar side of the flexor tendons with its centre over the wrist-joint. The flexor tendons with unopened sheaths were pulled laterally, the ulnar nerve was seen medially, and the carpus exposed. The dislocated semilunar bone lay anteriorly; the remaining carpal bones were closely approximated to one another and to the radius and ulna so that no space remained for the replacement of the dislocated bone. There was no scar tissue present, and the cartilage-covered surfaces of the bone appeared normal. A Steinman's pin was driven through the olecranon process, and a second through the base of the metacarpals, and the arm placed in the screw-traction apparatus. Traction was slowly applied, its effects being watched through the wound. The carpus gradually separated from the radius, a very powerful force being required, and a space for the semilunar bone reappeared. An attempt was then made to press the dislocated bone back into position, but it was impossible to move it. Gentle force with various levers was applied without success. Finally, it was discovered that pressure on the semilunar bone and simultaneous relaxation of the screw-traction resulted in its readily returning into its normal position, and there appeared to be no tendency for recurrence of the dislocation. The wrist-joint was put through its full movements, the wound closed

by skin sutures, and a plaster applied from the axilla to the bases of the fingers with the elbow flexed to a right angle, the forearm in the mid-position between pronation and supination, and the wrist in very slight dorsiflexion. The plaster was retained for one month. Recovery was slow, but gradually became almost complete. At the time of writing—August 15, 1938—there is a slight limitation of flexion and supination, but function is very good. Radiographs show slight arthritic changes with

some rarefaction of the carpal bones, but these appearances are becoming less manifest.

The interesting features of the case were:—

(1) The considerable force required to separate the carpus from the radius so as to make room for the replacement of the displaced bone.

(2) The absence of any scar tissue or changes in the bones and their articular cartilages.

(3) The easy reduction of the dislocation by a combination of pressure over the bone and relaxation of the traction.

It appeared that it would have been possible to effect reduction of the

dislocation by the use of the screw-traction apparatus without making an open incision. In a similar case it would seem reasonable to fix the limb in the screw-traction apparatus, as described above; to apply traction with the limb under observation with the X-ray screen; and to attempt reduction by a combination of pressure over the semilunar bone and relaxation of the traction. Only in the event of failure of this method would it seem necessary to make an open incision.

I am indebted to Colonel J. T. Simson, Assistant Director of Medical Services, China Command, for permission to forward these notes for publication.

[1] BÖHLER, "Treatment of Fractures."

A CHEAP AUTOMATIC CONTINUOUS CHLORINATOR.

BY LIEUTENANT-COLONEL J. C. CHUKERBUTI, M.B., D.P.H., D.T.M. & H.LOND.
Indian Medical Service.

A.—REQUISITES.

(1) Two petrol or crude oil drums of the same dimensions (ordinary 5-gallon drums).
(2) A few inches of glass tubing.
(3) A few inches of rubber tubing.
(4) A metal or wooden clip.
(5) A piece of flat cork (floater).
(6) A piece of tin sheeting (contact plate).
(7) A regulating stop-cock with fine adjustment.
(8) A few inches of stout galvanized wire.

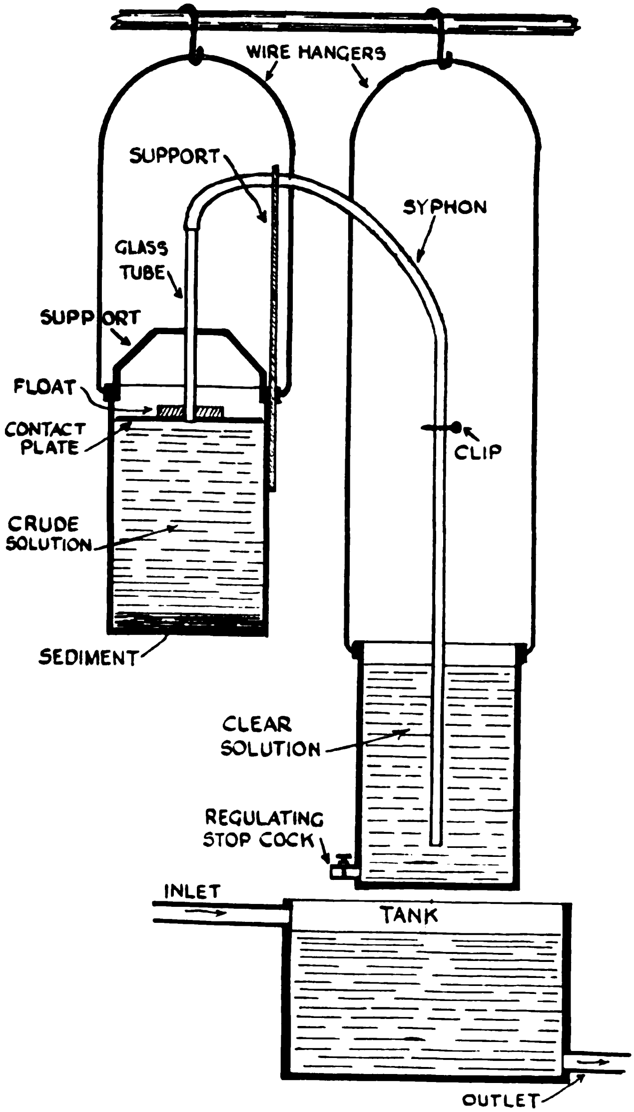
B.—GENERAL DESCRIPTION.

(*a*) *Method of Construction.*

(1) Fix to the underside of a flat piece of cork (floater) a round piece of tin sheeting (contact plate) so that when the floater is placed on the water the contact plate floats exactly on the surface level. Bore a hole through the centre of cork and plate and insert a piece of glass tubing which should stand vertically to a height of 3 inches above the top of the drum, while the lower end should be flush with the contact plate.
(2) Attach to the upper end of the glass tubing rubber tubing of a length equal to twice the height of the drum plus 4 inches.
(3) Bore a hole at the bottom of the second drum and solder the regulating stop-cock into the hole.
(4) Hang both the drums side by side by means of wire loops to the roof or to a hanger so that the top of the second drum is on a level with the bottom of the first drum.

(*b*) *Method of Working the Chlorinator.*

(1) Measure out the required quantity, ascertained by Horrocks' test, of the bleaching powder and put it into the first drum. Make a paste of the powder with just enough water and then fill the



drum with water up to 2 inches below the top. Stir the solution with a clean rod and allow the jelly-like flakes to settle at the bottom.

(2) Dip the rubber tubing along with the contact plate into water, drive out all the air in it and fill it with water. Put on the clip

at three-quarters of its length away from the contact plate. Now place the contact plate very carefully on the surface of the solution in the first drum and the other end in the second drum, so that no air can get into the syphon system. Undo the clip and syphon off the clear top portion of the solution into the second drum. The contact plate will keep to the surface as the level of the solution goes down in the first drum until the sediment is reached.

(3) Carefully manipulate the regulating stop-cock over the opening of the inlet pipe until the desired number of drops required per minute are counted by means of a watch so as to spread the whole solution by drop method over so many hours as will be required to fill the tank. Now open the sluice of the inlet pipe. The number of drops per minute will have to be calculated according to the number of hours required daily to fill the remaining portion of the tank when some water already chlorinated may be left over. Personal equation will probably play an important part at this stage.

(4) Clean out both the drums daily before use.

C.—ADVANTAGES.

(1) Uniform chlorination of all the water entering the tank achieved.
(2) Sediment in chlorine solution excluded by special syphonage system.
(3) Cost rendered trivial.
(4) Partial automatism secured.
(5) Continuity ensured.
(6) The materials, size and design alterable to suit the situation.
(7) Tried in large swimming baths fed by shallow wells worked by Persian wheels and found quite satisfactory.

FEVERS OF THE TYPHUS GROUP IN NORTHERN INDIA.

BY LIEUTENANT-COLONEL T. O. THOMPSON,
Royal Army Medical Corps.

THE following note, which is based entirely on the memory of occurrences of some ten years ago, may be of interest in connexion with this subject and particularly in regard to the critical article by Blewitt which I have just re-read during a return voyage to India.

A brief account of the outbreak was given by me at the Congress of the Far Eastern Association of Tropical Medicine at Calcutta in the year following the outbreak.

As D.A.D.H., Meerut District, I received information that an epidemic

of tick fever had broken out in the Viceroy's Bodyguard at Dehra Dun, at which place this Guard was quartered during the hot weather months. Although we included their statistics in our returns, the Guard was then under medical charge of the Civil Surgeon and not under the military I.M.S. officers of the Station nor of the District.

However, to learn what was happening with a view to limitation of any infection in the Cantonment, I visited the area and by the courtesy of the Civil Surgeon saw all the lines, one case and the precautions being taken, together with the results.

Eventually there were in all seven cases with four deaths; an original case which died, then three others which died and then three more.

The last of the second group of cases was dying at the time of my visit and on the fourth day of his illness.

The outbreak was attributed to infection from the bites of ticks acquired in a certain valley to which the Guard took their horses for grazing. It was stated that dogs became heavily infested with ticks in this area. It was also stated that the horses got ticks on them and "that the men had probably been bitten there too."

On going carefully into the history of the cases we found that the first case, instead of giving a history of having been bitten in the tick-infested valley, gave a history of having reported sick four days after returning from leave. He had been four days on his way back from his home, which was in the Kashmir-Jammu State close to one of the main trade routes from the interior of Asia, and he had been to a festival a week before the return journey. This gives an incubation period of about fourteen days if the festival was the source of infection.

The next three cases had all started ten to twelve days after the first man had reported sick; but all gave a history of having grazed their horses in the tick-infested valley, as had all the Guard, but gave no definite history of tick bites.

The next three cases were in a group which occurred eight to ten days after my visit, and then there were no more cases.

It may be noted that in each case an incubation period of approximately fourteen days holds good.

On visiting the men's barrack-rooms it was obvious that the personal hygiene of the men was deplorable and much below that which would have been allowed in any of the units in the Cantonment, and that there were no arrangements for hot baths other than a degshie of hot water from the kitchen.

The precautions taken had been: (*a*) to counter the order permitting grazing in the suspected valley, (*b*) to "disinfect" the clothes of the patients and contacts and to "fumigate" the barrack-room.

A real cleansing of the whole place; disinfection by steam and adequate

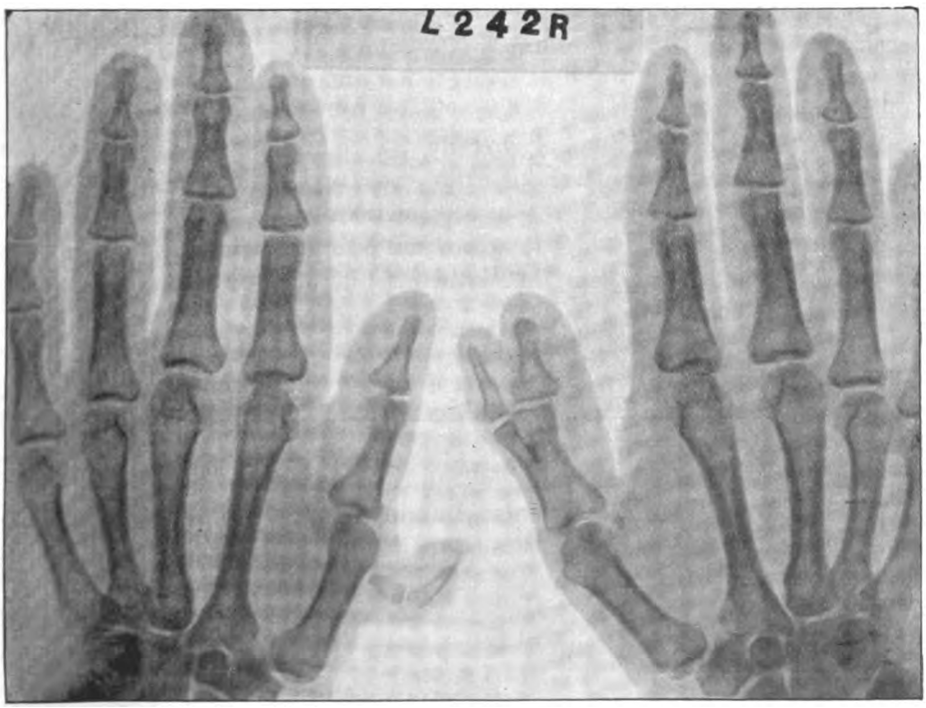
washing of all clothing of the whole Guard and provision of proper bathing facilities were advised and carried out.

Of the cases there was only the one dying patient in the Guard hospital at the time of my visit and we went in to see him. He was obviously desperately ill, appeared to have a definite rash and a high temperature. The first most noticeable feature of the case on closer examination was that on the outer side of the patient's sheet, apparently crawling diligently away from the patient, was a full-grown body louse.

POLYDACTYLISM, SYNDACTYLISM, OR BOTH?

By Lieutenant-Colonel K. P. MACKENZIE,
Royal Army Medical Corps.

THE accompanying print, which is self explanatory, is sent for its clinical interest.



The patient, an Indian gardener of small stature, gave no history of any abnormality in his parents.

ALLERGY?

By Major W. PARSONS,
Royal Army Medical Corps.

Major "X" of the R.A.M.C. telephoned to me at 10.45 on the night of August 22, 1938, stating that he had been stung by a wasp on the second finger of the left hand some thirty minutes previously and that he was fast developing a diffuse coarse rash all over the body and that he was driving up to the hospital for advice and treatment.

On arrival about fifteen minutes later the face was flushed and swollen and the skin over the body and limbs was becoming rapidly covered with an urticarial rash.

Indeed, so rapid was the spreading of the rash that it could be watched with the naked eye, involving areas not already affected.

It was evident on his arrival that not only was the patient seriously ill but rapidly getting worse.

The site of the sting was swollen, tense, pale and the hand on that side was perceptibly larger than the right.

He complained of headache, throbbing and fulness of his head and a sensation of burning and swelling of the whole body. He stated that the fingers and toes felt as if chilblains were coming out on them.

The pulse, which on his arrival was rapid, full and bounding, soon began to pass into one of a small and thready nature and finally became almost imperceptible and his general condition was very serious. There was no impairment of vision and no respiratory distress.

These symptoms developed within ten minutes of his arrival at the hospital and it was obvious that treatment of an immediate and drastic nature was called for.

A hypodermic injection of 4 minims of 1 in 1,000 adrenalin-hydrochloride was given.

The resulting improvement was as rapid and spectacular as had been the onset of the symptoms.

Within one hour he stated he felt quite all right.

The pulse had returned to normal, the rash rapidly subsided.

He was detained in the officers' ward for the night and soon fell off to sleep which was uninterrupted till the morning when he got up and not only drove home to breakfast, but was fit enough to play in a tennis match in the afternoon and to all outward appearances was as fit as he was before the accident.

About twenty-five years ago the patient had a very severe attack of diphtheria and was treated with large doses of anti-diphtheria serum.

The salient facts of this case are considered worth recording as illus-

trating the rapidity of the onset of an allergic state and the need of immediate treatment.

The case was far more serious than a simple urticaria from a wasp sting and was probably due to an acquired sensitivity.

An added point of interest in this case is the letter of Dr. F. O. Taylor of Coldingham in the *British Medical Journal* of August 27, 1938, which records his experience of a very similar case some few days previously in which the same treatment was adopted with similar rapid recovery.

In his case, however, the local reaction of the sting was more severe and prolonged.

I am indebted to Colonel A. L. Stevenson, A.D.M.S., East Anglian Area, and Lieutenant-Colonel O. R. McEwen, R.A.M.C., Officer Commanding Millitary Hospital, Colchester, for their permission to send the notes of this case for publication.

Travel.

KENYA.

By Lieutenant-Colonel F. S. GILLESPIE,
Royal Army Medical Corps.

(*Continued from page* 206).

January 21: We moved back to Nanyuki and stayed at "Sportsman's Arms," a delightful little hotel. On the way we fished the Naro Maro river, where I was the only unsuccessful one. We passed on the way another river, which had a board with the following notice, "Crown Lands Fishing—Burguret River—Beware of Rhino." I gather that it is quite a common occurrence for fishermen to be pursued by angry rhino on the banks. As there were other rivers near by with no such disadvantages we fished in them so I can give no first-hand information about the Burguret.

January 22: We fished the River Liki which runs through Nanyuki, a very nice river mostly passing through forest, with beautiful runs and pools. I had twelve fish, chiefly on a fly spoon, Ivy three, Ivor and Rita twelve between them. In the evening we drove up the slopes of Mount Kenya to a forest rest house from which we got a gorgeous view of the mountain with its forest-clad base, grassy slopes above, and then rocky rugged pinnacles partly covered with snow, rising to over 17,000 feet. From the house where we left the car we walked a mile or so to a rise from which we could get a good view of the forest glades, and we had hardly got there when a herd of buffalo came out to graze. We had a fine view of them through glasses.

January 23: Ivy and I got up early and went for a run of about 20 miles on the road to Thomson's Falls to try and get a photo of giraffe; lots of zebra and gazelle, ostrich and oryx, but no giraffe. After breakfast we fished the Liki again with little success. We saw a fine Colobus monkey and followed him for a bit through the forest to admire his fine black and white coat and white tail with hair about 6 inches long. After lunch we made our way back to Embu via Nyeri, completing the circuit of Mount Kenya. Nanyuki, which is on the railway, struck us as a good centre for anyone paying a visit to Kenya, several rivers within easy reach, lovely views of Mount Kenya, big game in great variety close by and a very nice hotel.

January 25: We fished the Thiba at a lower stretch where fish were reported to be bigger, but less plentiful. There was thunder overhead and not much moving; however, I realized an ambition long unsatisfied, a trout of over 2 pounds; he put up a great fight and nearly got in under the bushes beside the bank on several occasions.

January 27: We started off after breakfast for a visit to the Kenya Fly Fishers' Association Camp in Glen Tuso on N. Mathioya river, as guests of the Cox family, a delightful camp on the slopes of the Aberdares with a wonderful view and the river down at the bottom of a deep valley below us; this river is stocked with brown trout and provides excellent fishing at times, but they were not taking well when we were there.

January 28: Walter Cox got two nice fish of 2 pounds each before breakfast and put back another bigger one in poor condition. I toiled all day and only moved two before evening and then got a nice 1¼ pounder. Ivy moved a couple but got none. It was the nicest river we had fished, but for some reason they weren't taking—even Walter, who is a good fisherman, only got four all day.

January 29: Walter and I started at 7 a.m. and fished up-stream; he led me to the pool in which he got two yesterday and I was soon fast in a nice fish, 1 pound 14 ounces. I moved a couple more, but he had no luck so we climbed up the steep hill to a well earned "brunch," after which we returned to Embu.

January 30: We started off at 8 a.m. for Nyeri where Ivor had an urgent official call to make before starting on a long tour of visits and sightseeing. Nyeri is a pretty spot with a good 18 hole golf course and some good rivers within easy reach, also an hotel which has a branch in the forest slopes of Mount Kenya, called Tree Top Hotel, where visitors have rooms in a platform erected in large trees—all sorts of game can be seen from it. A lady we met had spent a night there recently and seen rhino and the rare giant forest hog. Ivor's business completed, we pushed on along the base of the Aberdares and over a plateau swarming with zebra, oryx, gazelle and ostrich to Thomson's Falls where we had tea and then

on over the rolling downs, rather like Salisbury Plain, with a gorgeous view back over Aberdares to Mount Kenya and forwards to the Great Rift Valley, that amazing cleft which stretches from the Red Sea down through to South Africa. Our goal was Nakuru in the bottom of the valley and as we wound our way down the hillside we could see the crater of Menengai, an extinct volcano, on one side, and Nakuru lake on the other side of the town. We were glad enough to get to the end of our journey of 230 miles.

January 31 : We were up in good time and drove up to the top of Menengai to see the crater, a rather forbidding spot with a sheer drop into the crater, now well covered with scrub jungle. There was a fine view of the lake and even at a distance of 3 miles we could see that part of the lake had a broad pink border caused by the millions of flamingoes which congregate along its shallow edges. We went down to have a closer view of this amazing sight. The lake is impregnated with soda and very shallow and at certain parts the borders are a moving mass of these handsome birds with their pink wings. We pushed on at about 11 a.m. and stopped at Njoro to call on Colonel and Mrs. Kilkelly. He is a retired R.A.M.C. officer and came out to spend three months with his daughter and stayed seven years, having taken a house nearby. His son had been a patient in the Citadel at Cairo just before I left and I called to give his parents news of him. On from Njoro and through Molo to the top of Mau Escarpment, fine rolling grass country, split up into large farms growing wheat and running big herds of fine English cattle and sheep, we made another call this time on Alec Hemphill, a young brother of poor Robert who was killed so tragically a few years back. Alec has a very fine farm near Molo, a delightful bit of country at about 8,000 feet altitude. We got to Eldoret about 6 p.m. and were hospitably entertained by the D.C. there, Lindsey.

February 1 : We set off soon after breakfast along a road where giraffe were reported and 10 miles out came on a herd of nine, which allowed us to approach quite close; in fact they seemed nearly as interested in us as we were in them and we stayed about half an hour watching and taking photos. Unfortunately my good camera with telephoto lens had had a fall and the shutter had struck work and I had sent it to Nairobi for repair. I got some quite fair pictures with an ordinary camera. We returned to Eldoret and left Ivy and Rita to shop, while we had a round on the local golf course, a very nice course too, except for a confounded river which meandered through it like an intoxicated snake and left the Gillespie family poorer by six balls in the course of two rounds. We took on Lindsey in the afternoon with our best ball and succeeded in defeating him, which cheered us. Dinner with Pailthorpe, the local R.M., who told me of a most unpleasant incident when he was mauled by a lion.

February 2: We started off for Tambach, intending to call at

Kapsiliat, the home of Mervyn Ridley, with whom we were to stay two days later, when about 3 miles from his house the main leaf of the front spring broke; most fortunately we were travelling quite slowly and on a a decent track. Had it happened later in the day on the Tambach road, the consequences might have been serious. The car, a Ford V8, was fitted with auxiliary springs fore and aft so we were able to drive on and leave the ladies and luggage at Kapsiliat, while we returned to Eldoret and got a new spring fitted. We got back at 5.45, loaded up and set off for Tambach, a former station of Ivor's where he had been responsible for planning and making a road down into the Kerio valley, a very backward part of the district. At Tambach we stayed with Howitt who ran a school for native boys, an excellent show, where they learned carpentry, building, blacksmith's work and basket work and farming. They seemed a happy, well-set-up lot and he said he could have taken many more if accommodation were available. Many of the boys preferred staying at the school to going home for holidays and had no difficulty in getting work when they left school. Tambach is on a shelf in an off-shoot of the Rift Valley. There was a wonderful view from the house down into the valley.

February 3: We started off after breakfast to see the valley road of which we had heard so much during its construction. Ivor could get no official sanction or money to begin it so he had made a start with prison labour after having plotted out the lines himself and had them vetted by an engineer friend. He had done a great deal of the preliminary blasting and had a most exhausting time in the heat walking down, surveying and cutting tracks through bush, blasting rocks and overseeing native workmen who knew nothing of road making and then climbing back a couple of thousand feet home again in the evening. When he had about 3 miles finished he asked his Provincial Commissioner to come and have a look at it; the P.C. said little but went back and pulled the necessary strings at headquarters and obtained the necessary sanction for the work to start. The road was a most hair-raising piece of engineering with sheer drops of hundreds of feet into the valley and we were devoutly thankful that the front spring had chosen the previous day to break. The inhabitants of the valley, Nandis, I think they were, were armed with bows and arrows, and wore very little clothes; some wore none, very suitable for the climate, which was intensely hot and dry, and we were glad enough to get back to Tambach 2,500 feet up for lunch.

February 4: We returned to Kapsiliat and spent the afternoon fishing the Moiben river, very narrow and overgrown. I had no success but Ivor got a few small ones. The ladies joined us at 6 p.m. and we went out in a punt on the dam which had been erected to provide power for a mill and electric light plant for the farm; once it got dusk we had good fun with the rainbows which started to rise all around us. They don't rise to

natural fly in most places so it was all the more fun when they did here. There was a certain amount of criticism of the ladies' skill which evoked some rude retorts; however, they caught fish which was the main thing. We caught no big ones, but a dozen or so small ones gave us a lot of fun and we didn't tear ourselves away till it was pitch dark. A drink, a bath and dinner were all equally welcome and we slept like logs.

February 5 : We set off for Nakuru through Eldoret and I picked up my good camera which had been sent up from Nairobi. Off to Nakuru taking a different road after climbing Mau Escarpment down through Eldama Ravine. When within 8 miles of Nakuru we saw a large bush fire ahead, and thinking we might get past before it crossed the road we ran up close to it only to find that we could not pass in safety. Ivor then started to turn but as the road was narrow we soon realized this was impracticable and started to back out. The flames came along at a most alarming speed and were roaring along 15 feet high with a high wind behind them. We only just got clear with a couple of minutes to spare, an exciting experience. After watching for some time we realized there was no hope of getting through and made a detour of 15 miles to Nakuru. After tea we went out to a camp just outside the town, where Mr. and Mrs. Leakey were excavating ancient lake dwellers' huts and were shown their finds, chiefly skeletons and ancient knives, scrapers and arrow heads made of volcanic glass which is quite common in the Rift Valley ; Leakey had skinned and cut up a Thomson's gazelle with one of the knives to prove its efficacy.

February 6 : We went on 40 miles on the main Nakuru-Nairobi road, and a shocking road it was, to stay with Mr. and Mrs. Heath on Lake Naivasha in a house they had taken furnished for a year, while they built a new house 5 miles further along on the lake shore. The house they occupied was a most attractive one on the edge of the lake with a wonderful flower and vegetable garden. The soil is volcanic ash and seems to grow anything that is put into it. After tea we went along to see their new house in course of construction and it made us wish we could follow their example and settle in this little gem of a place, with lake and hills all round. While we were there the Imperial Airways Flying Boat from Kisumu landed on the lake as it was too late for it to make the trip to Mombasa.

February 7 : We were awakened by the flying boat making an early start and before breakfast strolled round the garden and were taken over to the neighbouring house of Mr. and Mrs. McCrae who were away. They had a wire enclosure in front of the house in which were two cheetah. We were told they were quite tame, and that Mrs. M. used to take them out on a lead. While we were watching them their attendants came along and brought their morning meal, a big lump of kongoni meat. They brought this into the enclosure and the cheetahs got down to it at once. I was trying to get a photo when Ivy and Rita suggested that I should go inside. I went in

and was just getting into a nice position for a snap when the male cheetah, evidently thinking I had designs on his breakfast, made a rush at me, fortunately he stopped within a few feet and I made a dignified departure. The photo turned out to be as shaken as I was. After breakfast we drove round the lake to a bay which was reputed to be a sure find for hippo. Unfortunately just before our arrival one had been disturbed by a Mr. Evans who was in camp there with his wife taking photos of game. He told some of his experiences. One night he was awakened by his wife who said that there was a lion just outside; like many a husband, he was going to treat the tale of a midnight marauder a bit light-heartedly; however, he looked out and sure enough there was a lioness sniffing about the verandah, so he got his rifle quietly from the bedside and fired; she departed a short distance evidently badly hit and was joined by five companions who prowled about just outside till daybreak and then departed with the wounded one, which he followed up and killed. The lions had thoroughly investigated the kitchen tent and carried off the aluminium coffee pot which was found some distance away chewed out of all recognition, except for its steel handle. We went on a few miles to see a lake in an extinct volcano crater, a beautiful spot with trees coming down to the water-side all round, we looked down from the crater edge at the lake about 300 feet below. The water was a uniform light green colour which gave a curious effect. We picked up some pieces of volcanic glass, I believe obsidian is its correct name, and there were large pieces lying about fused on to pieces of rock. The whole area is volcanic and in many places there are jets of steam coming out of the hillsides. We left after lunch for Nairobi about 70 miles off and passed through Limuru at tea time and stopped at Brackenhurst Hotel for tea—we had time for a game of golf on the hotel course, a very pleasant 9 holes with grass greens; I found the uphill holes a bit trying at 8,000 feet altitude. We got into Nairobi for dinner.

February 8 was spent shopping and I bought a couple of spoons and minnows and some gut substitute and swivels to deal with some of the larger trout and particularly one which had twice broken me. In the evening we went out on the Athi Plains game reserve and I got some nice photos of zebra and wildebeest with the telephoto lens.

February 9: We returned to Embu and found the accumulated mail of ten days awaiting us and were kept busy answering letters the next day.

February 12: I had made up a couple of stout casts, soaked them well and fixed on my new spoon, a red and silver 1 inch affair with two single hooks and was itching to try it out, so we set off once more for the Thiba. I first of all tried the fly and lost two in one pool, one a nice fish of 1 pound or more, got one of ¾ pounds and then got to a deep pool under a big waterfall I very soon had a beauty on the big spoon and he put up a great [illegible] vely 2-pounder. He was soon followed by another of 2 ounces

less, he followed the spoon across the pool three times before finally falling a victim to its charms. All this time I had been keeping the best pool for a titbit and eventually got down to it, a deep corner just above a rapid with a bed of rushes around a rock. I had several casts before I eventually got the spoon to come past the rock where I knew the big one lay, and what a thrill when I felt my strike go home; I was glad of a stout cast as I didn't dare let him over the rapids, and it was a ding-dong struggle for a good bit before he eventually came to the surface and I suppose fully five or six minutes before I got him into the net, a record for me, 3¼ pounds in lovely condition. Ivy came along just as I had him out so we sat down and had lunch. We then went down below the falls and I put Ivy to fish a nice pool as near the falls as we could get. Not being satisfied with her method of casting, I said "Stop a moment, and watch me. You just swing it out underhand like this and then draw in slowly, and then you have a fish on", which I had, a 1¼ pounder. I was lucky to escape personal assault for I had done exactly the same on the Liki and in each case it was the only feeding fish in the pool. It came on to rain very heavily soon after and we got soaked and had a most unpleasant drive home. I had a dry coat and pullover and put them on, but after a few miles the road was so slippery that I had to put on chains. A couple of local natives passing got a shock at seeing a "bwana" clad only in a pair of shorts wrestling with chains. I wiped myself fairly clean with wet grass and put on my dry clothes again and got home safely after cutting away part of a tree which had fallen across the road.

(*To be continued*).

Current Literature.

McIntosh, J., and Whitby, L. E. H. **The Mode of Action of Drugs of the Sulphonamide Group.** *Lancet*, February 25, 1939.

The authors conclude from their experiments that:—

(1) Sulphonamide drugs do not stimulate leucocytic or phagocytic activity.

(2) Sulphonamide drugs do not affect the speed of production or the quality and quantity of specific immune bodies.

(3) Sulphonamide drugs, both *in vivo* and *in vitro*, are not instantly active, and there is a quantitative relationship between the effective dose of the drug and the number of bacteria affected.

(4) Sulphonamide drugs are active on highly virulent organisms and those in the logarithmic phase of multiplication; they are inactive on "rough" organisms.

(5) Sulphonamide drugs are not simple germicides; they probably act by neutralization of some metabolic function or enzymatic activity.

MARGARINE.

By Colonel K. COMYN.

Margarine owes its origin to war—Napoleon III offered a reward during the Siege of Paris in 1870 to anyone who could find a substitute for butter. Mouries invented this commodity, and shortly afterwards the families of Jurgens and van den Berghs commenced production in Holland on a commercial scale.

Margarine has now become one of the most universal and constant items of the soldier's diet. Data culled from the messing books of various units show that the average consumption per man per day is 1½ ounces.

The fact that it has been arranged to vitaminize several brands of margarine as supplied to the N.A.A.F.I., without increasing the retail cost, has added considerably to the value of margarine as a food. It has long been a matter of controversy whether the soldier's daily diet gives him sufficient vitamins. Considerable stress has often been laid upon the provision of green vegetables, tomatoes, salad, etc., in order to provide vitamin C. But what of vitamins A and D? It has been presumed that there is sufficient of these in his ration of meat, bread, potatoes, bacon and cheese—and in summer months his outdoor life and sunshine enable him to produce sufficient vitamin D for his needs; but the soldier's food is always subjected to prolonged cooking which is deleterious to the vitamin content. To what extent the vitamin A is destroyed by this cooking cannot yet be measured. It seems possible, if not probable, that during the winter months the soldier's daily diet is deficient in vitamins A and D. It seems possible also that this condition of avitaminosis may play a part in the incidence of such diseases as tonsillitis and inflammation of areolar tissue, which includes many cases of boils, septic sores and abrasions so often associated with being "run down." These two groups of diseases cause a very large proportion of the sick wastage in Army life, especially in young soldiers.

The value of margarine as a vehicle for the addition of vitamins A and D to the soldier's food does not appear to have been sufficiently recognized—the factors which determine its value are (i) its universal daily use, (ii) its use in the raw state, only occasionally being used for cooking, (iii) its use within the maximum period of three weeks from manufacture.

Perhaps a brief description of the composition and method of manufacture of margarine may be of interest.

Composition.

Taking an average from several brands:—

Protein	..	..	0·2 per cent.
Fat ..	..	..	84·8 „
Salt ..	..	..	2·0 „
Water	..	..	13·0 „

The protein is derived from added milk; the fat is derived principally from vegetable oils. The salt has to be added during the process of manufacture.

Several Acts of Parliament have been passed governing the manufacture, sale and distribution of margarine, but these have now been covered by a Consolidation Act—"The Food and Drugs (Adulteration) Act 1928." The principal points of this Act are that margarine shall not contain more than 16 per cent water, or 10 per cent butter, and be free from preservative, other than common salt. (This provision does not apply to margarine consumed outside the United Kingdom.) There are also several regulations regarding the branding of the word MARGARINE on the boxes, and on any wrapper in which it is enclosed.

The War Office has a contract standard laid down in the Handbook of Specifications for Supplies, 1930. The principal details of this specification are that the margarine must not contain more than 16 per cent of water, not more than 3 per cent salt, and be free from preservative. In the case of margarine for hot climates, the melting point of the fat shall not be less than 31° C. nor more than 35° C., as determined by the cooling curve method. This quality is packed in hermetically sealed 2 lb. tins.

Food Value.

The food value, apart from any added vitamin, depends entirely upon that of the fat or vegetable-oil content, the protein being negligible. The vitamin content in the vegetable oil is nil, and that of added milk or animal fat so slight as to be negligible.

The caloric value of the vegetable oil is high. The average of a number of samples according to Professor Plimmer's tables is 3,579 calories per pound, so that 1½ ounces of margarine will provide the soldier with approximately 335 calories, or one-twelfth his total daily requirement, at a cost of less than ½d.

Keeping Quality.

If kept under ordinary conditions of coolness (under 12° C. recommended) and cleanliness margarine will remain fresh and suitable for use for three weeks. It will keep longer, but prolonged keeping is not recommended. The manufacturers will guarantee the keeping qualities up to six months if this is specially stipulated in the contract, but that would necessitate a special quality and special packing in sealed tins as is done for margarine sent abroad.

Manufacture.

The process of manufacture may be conveniently divided into various stages for descriptive purposes:—

(1) *The Production of the Vegetable Oil.*—The oils used in manufacture are all of vegetable origin obtained by crushing the seeds of many plants.

The more commonly used are groundnut, cotton seed and soya bean. There are very few plant seeds from which the expressed oil cannot be utilized. In a few cases some poisonous or toxic substance prohibits their use.

The oil is expressed in factories at Selby, Liverpool and other towns in the north, and the crude oil is transported in tank waggons to the margarine factory at Purfleet.

(2) *Refining the Oils.*—The crude oils after expression always contain some impurities which are undesirable, and which have to be removed. For example, fatty acids impart undesirable tastes or odours, and colouring matters cause variations in the appearance of the finished article.

The oils are subjected to processes of neutralization to remove fatty acids, bleached with charcoal or bleaching earth to remove colouring matters and some other bodies that are not pure fat, and distilled to remove volatile substances. The pure oil thus produced is pressed through filters made of cotton cloth and filter paper. When finished, the oils and fats are odourless, colourless and tasteless.

(3) *Blending of Oils.*—The various oils are put into large tanks which are heated to a temperature which will keep the oil liquid. The melting points of the different oils vary considerably. This materially affects the condition of solidity or stability of the finished article. It is essential that the margarine should have a definite stability and known melting point, not only from the point of view of marketing and keeping quality, but also that of digestibility. The digestibility depends considerably on the state of solidity and melting point. To this end the requisite quantities of the different oils are run into the blending vats to give the correct mixture which will give a product with a definite and constant melting point, not too high to cause indigestibility nor too low to render it soft in warm weather, and to give a digestibility equal to butter.

The proportions of the different kinds of oil necessary for blending are known, so that it is unnecessary to test each churn or mixing for melting point or to work out proportions in each particular case.

(4) *Proportion of Milk.*—The milk used at Purfleet is pasteurized liquid milk. Samples of this milk are tested bacteriologically every day. It is again pasteurized by the flash method at 190° F.

The object of milk-blending is chiefly to impart the required flavour to the margarine; it is not intended to increase or alter in any way the food values. To acquire the flavour that is necessary the milk has to be "ripened." This is done by adding standard bacterial cultures of lactic acid and other allied bacilli, and incubating the bulk of the milk in large vats in which rotating paddles keep the milk in constant motion. The temperature during this process is maintained at 18° to 28° C., and the process continued for a period of eight to twenty hours varying with

the activity of the bacterial action. The milk is tested periodically during this time for the amount of lactic acid formed, and when this is found sufficient, the ripening process is stopped by cooling off.

(5) *Churning.*—The two chief constituents are now ready to be blended for the final processes. The refined oil mixture and the ripened milk are run from their respective vats or tanks through pipes into the mixing vats, where, by constant stirring with revolving paddles, a homogeneous emulsion is made. During this process the requisite amount of colouring matter is added. This colouring matter is one of the soluble coal tar derivative dyes permitted by the Ministry of Health, and which is very constant in imparting the same colour to the finished product. The proportion of milk blended with the oil varies from 10 per cent to 30 per cent, the variation depending mainly upon the quality of the margarine and upon the flavour required.

The temperature of the mixture in the vat during mixing and churning is kept at a few degrees above the melting point of the oil or fat. The process of mixing, blending or churning is continued for about thirty minutes.

(6) *Addition of Vitamins.*—In the better brands of margarine vitamins A and D are added in the form of standard concentrates, which are obtained from sources rich in these accessory factors. They are added during the churning or mixing process.

The presence of vitamins in these brands is subsequently proved by testing samples just before packing. These tests are chemical (Carr and Price modified by Anderson and Nightingale), physical (ultra-violet rays) and animal feeding.

(7) *Cooling and Kneading.*—Up to this stage in the manufacture the oil or fat mixture has been maintained at a temperature a little above its melting point to prevent solidification, and the final milk blended, vitaminized, coloured and thoroughly churned mixture has now to be cooled and solidified into the final product which is recognized as margarine. If the emulsified mixture is allowed to cool slowly, there is a tendency to crystallization of some of the constituents, similar in appearance to that observed when butter is melted and then cooled slowly. To prevent this effect, the emulsion on completion of the churning process is rapidly cooled. Cooling is started in the churning vat by adding cubes of ice which are made in an adjoining section of the factory. The emulsion, while still liquid, is then run by pipes to large metal rollers, on to which it is poured from fine jets forming a thin layer on the metal surface. The rollers are cooled to a temperature of $-15°$ C. by the evaporation of liquid ammonia circulating through them. The layer of emulsion is rapidly solidified into a homogeneous film. This film on the rollers is approximately $1\frac{1}{2}$ millimetres thick. It is scraped off by a knife edge abutting on

the under surface of the roller and is deposited in large aluminium trucks which are run underneath the cooling machine. This machine cools four tons per hour, each truck taking approximately twenty minutes to fill.

After the margarine has been mixed or churned, rapidly cooled and scraped off the cooling rollers, it is still in a somewhat brittle or friable condition, which is unsuitable for ordinary use. In order to impart to it a more cohesive or spreadable character it has to be kneaded. This is done by passing it between closely applied revolving rollers, set in pairs, revolving in an inward direction towards each other, so that the margarine deposited on them from above is rapidly carried through between the roller surfaces. The gap between the rollers varies according to the quality of margarine being manufactured at the time. The average gap is $\frac{1}{4}$ inch. There are three pairs of rollers through which margarine passes consecutively. From beneath each pair of rollers it is conveyed to the top of the next pair on a travelling belt made of a special composition of rubber and canvas. From beneath the third pair of rollers it is deposited into large collecting bins.

During the process of kneading the requisite amount of salt is added Samples are tested just before the kneading for salt content and water content. The salt content is invariably below 3 per cent, and salt is added as required, the kneading process ensuring an even distribution throughout. The water content is usually round about 12 to 13 per cent varying chiefly with the amount of milk blended in and the amount of kneading that has taken place during the manufacture.

The margarine is now finished and ready for weighing and packing.

The varieties of margarine differ mainly in the quality of the fats and oils used and also in the flavour imparted by milk blending and in the food value of added vitamins.

My thanks are due to Mr. Anderson of the Technical Department, and to Mr. Euren of the Sales Department, of Messrs. Unilever, Ltd., for their courtesy and patience in describing the details of manufacture.

Editorial.

NOTES ON CANCER.

THE mortality from cancer appears to be slowly increasing. The crude death-rate in 1936 was 1,625 for both sexes per million living, the rate for males being 1,612 per million and for females 1,636. The rate in the period 1901-05 was 867, and in 1937, 1633; the rate now is twice that at the beginning of this period.

Nearly half the cancer deaths (48 per cent) occur in persons under 65 years of age. During the working period of life, from 15 to 65 years of age, 17 per cent of all the deaths which occur are attributable to cancer.

Most investigators are now agreed that the recorded increase in mortality does not necessarily mean augmentation of general constitutional factors. The rising rates, however, do increase the seriousness of the administrative problem of provision of adequate means for diagnosis and treatment.

In the text volume of the Registrar-General's Review a table of standardized mortality rates for individual organs appears for the most important sites for each sex. From this table it appears that in accessible organs, such as the lips, tongue, jaw, uterus and skin, while the rates have fallen considerably between the earliest and latest periods, they have remained practically stationary, with a tendency to fall, in the last five years. In these accessible sites in which increasing accuracy of diagnosis has played only a small part, the falls are probably due to a combination of diminished frequency and the effect of treatment. Another group consisting of the stomach, intestine, rectum, lung, pancreas and prostate shows a marked rise over the longer period and a tendency to rise over the shorter period. On the rates for such organs treatment can have little effect and the rises are due to increased incidence combined with more accurate diagnosis, or both. Experience suggests that improved diagnosis is the more important. This receives support from the fact that in an intermediately placed group, the pharynx and œsophagus, where the influence of diagnostic and therapeutic changes is small, the changes in the rates are small suggesting that changes in incidence are also small.

Investigation into the cause of cancer through laboratory research continues with increasing vigour, and details of the various experiments are given in the Report of the British Empire Cancer Campaign, and in the report by Dr. Gye of the work carried out by means of the Imperial Cancer Research Fund.

Research work is also being carried on at the Royal Cancer Hospital, the Middlesex Hospital, cancer research laboratories and other large

hospitals in London. In the provinces, there are centres at Sheffield, Leeds, Newcastle, Birmingham and Manchester. The Medical Research Council's investigations extend to research in all medical problems including cancer.

In less than a lifetime both knowledge and treatment in regard to tumours have improved out of recognition. It is only within the last few years that operations for cancer have been based on a precise knowledge of the spread of the disease. The causes of cancer yet remain obscure; but there is no doubt about certain of the causes, viz. the synthetic preparations. The study of growth stimulating and growth inhibiting substances seems likely to be a profitable field of research.

The major part of research has been directed fairly closely into two main channels: those connected with carcinogenic substances, and those initiated by the discovery of virus tumours in fowls.

In 1935 Dr. M. des Ligueris of South Africa reported that he had succeeded in inducing a malignant transformation in tissue cultures of normal chicken fibroblasts by adding a small amount of dibenzanthracene to the culture medium in which the cells were growing. Inoculation of chickens with these cultures resulted in the production of rapidly growing sarcomata from which after a number of serial transplantations a filtrable virus could be extracted. Immunological experiments with the des Ligueris sarcoma have shown that it is closely related to Rous sarcoma No. 1, and perhaps more closely to the Fujinami tumour, being like it communicable to ducks.

It has been found that if the Rous sarcoma agent is present in the body of a fowl it may pass to a chemically-induced tumour present at the same time. It has further been found that the Rous virus will pass not only from the Rous tumour to other tumours of chemically-induced type but also to the normal tissues. Extracts of many organs and tissues of fowls bearing the Rous sarcoma will produce new tumours when injected into fowls. These organs and tissues are free from sarcomatous growths, although rich in the sarcoma-producing agent.

Recent syntheses of derivatives of 1 : 2 benzanthracene has led to an increase in our knowledge of the types of substitution which lead to cancer-producing activity in the benzanthracene hydrocarbons. In this connexion it is of interest that 9 : 10 dimethyl—1 : 2 benzanthracene has proved to be the most rapidly acting chemical cancer-producing agent yet found as tested by capacity to produce cancer of the skin.

Many hydrocarbons known to be carcinogenic have been found to exert an inhibitory effect on cellular proliferation. It is suggested that these substances act by producing a prolonged retardation in the growth of the affected normal cells which eventually react by the production of a new cell type with permanently lowered differentiation and a correspondingly

increased fission rate. In this view the cancer cell is supposed to be a somatic variant developing in adaptation to protracted inhibition. The view is supported by the relative resistance of chemically-induced tumours to the inhibitory action of the carcinogenic hydrocarbons.

Work on the action of carcinogenic compounds on the growth rate of spontaneous tumours of the mouse has confirmed the inhibiting effect of parenteral administration 1 : 2 : 5 : 6—dibenzanthracene, which has been accompanied by partial regression in some 18 per cent of cases.

In the induction of epitheliomata, carcinogenic substances act not only on the epithelium which ultimately supplies the tumour cells, but also on the deeper tissues. The ultimate effect may be due to impairment of the nutrition of the epithelial cells.

Extracts of certain tissues exert an accelerating effect on the growth of chick fibroblasts *in vitro*, whereas extracts of other organs have no such action. Extracts of brain are more active in this respect than extracts of embryonic or other tissues. The growth-promoting power evidently does not depend on the rate of growth of the tissues from which the extract is obtained, but the tissues which are most active possess the most active powers of anaerobic glycolysis. The energy for growth seems to be in some way connected with the change from glucose to lactic acid.

It has been disputed whether cancer spreads within lymphatic channels as small emboli or by permeation. This question seems to have been settled by injections carried out with Thorotrast injection methods. These show that cancer spreads by means of minute emboli which are carried along the lymphatic channels and are arrested in the lymphatic glands. Thorotrast injections have shown the vessels to be patent, and certainly not permeated with cancer cells.

An investigation of the relationship between histological appearance and prognosis has shown that in the case of mammary cancer the presence or absence of axillary metastasis is the most important single factor in prognosis. Histological grading is of value when combined with the results of examination of the lymphatic glands. In a series of 172 patients only 19 per cent survived for ten years, but of the patients with Grade I tumours and no axillary metastases 57 per cent survived for this period. Age has little effect on the prognosis.

Reporting on the work of the Imperial Cancer Research Fund, Dr. Gye points out that the work in the laboratory at Mill Hill confirms observations made elsewhere.

In the Section on Carcinogenesis there is a renewed warning of the dangers of using Thorotrast in radiography. The substance appears to remain in the body indefinitely, and Dr. Foulds has produced both sarcoma and carcinoma at the site of its injection into guinea-pigs.

Though no cancers have yet appeared in human beings, it is considered premature to assume that Thorotrast is harmless, especially as bone tumours appear in workers who handle luminous paints.

Tar and carcinogenic hydrocarbons evoke squamous epithelioma when applied to the skin, or sarcoma when injected beneath it. The carcinoma produced by Dr. Foulds in the guinea-pig is apparently the first example of a glandular cancer produced by the local action of a carcinogenic agent.

Rous showed that if a rabbit's ear was painted with tar and Shope's papilloma virus was then injected intravenously it would be localized in the tarred skin and produce growths which from the first were malignant. Andrewes, Ahilström, Foulds and Gye have tried to produce connective tissue tumours in the same way. Tar was injected intramuscularly and the Shope virus intravenously, and in each laboratory one rabbit of a small series developed a sarcoma at the site where the tar had been injected; the usual effect was a fibroma at the site of injection and a general fibromatosis. Dr. Foulds found that the essential factor was the immediate tissue reaction to the tar, and not the presence of tissue which had been long in contact with tar and might be in a precancerous state. The conversion of fibroma to sarcoma was not again observed, and when Andrewes and Ahilström examined their sarcoma they could find no trace of virus in it.

In America it is reported that if 1 : 2 : 5 : 6—benzanthracene is repeatedly injected into rabbits they become much better media for the growth of transplanted Brown-Pearce rabbit carcinoma. It is suggested that substances containing the phenanthrene ring alter the tissues and make them more susceptible to tumour growth.

In New York Woglom discovered that subcutaneous abscesses arising as a complication of experiments with a rat tumour could be serially transmitted by a filtrable agent. Dr. Knox found this agent had an average diameter of about 0·2 micron. The interesting fact is that the virus is found as a contamination of a tumour and is pyogenic.

Dr. W. Cramer and Mr. Hornung, continuing their work on hormones, conclude that there may be a physiological antagonism between oestrone and the hormones secreted by the pituitary acidophil cells. Experiments on mice have shown that the thyrotropic hormone which stops the action of oestrone on the pituitary body and on the mammary gland also prevents in a specially selected strain of mice the spontaneous development of breast cancer.

Strong, of Yale, has found that the inclusion of heptylaldehyde in the diet of mice with mammary cancer causes extensive liquefaction of the tumours, and sometimes complete regression. The heptylaldehyde appears to act on the connective tissue framework of the tumours, and when it was applied to mixed cultures of fowl tumour cells and chick

fibroblasts no selective action on the growth of the cancer cells could be demonstrated.

The last section of Dr. Gye's report is concerned with radiation. It has been found that the glycolytic process used by the cancer cell is specificially vulnerable to radiation applied at low temperature. It is stated that experiments give no evidence of any dependence of biological effect on the quality of the radiation used. A given dose of radiation measured in rantigen units, whether gamma, beta or X radiation, produces exactly the same inhibition of retinal glycolysis.

In the Report on Radium Beam Therapy Research issued by the Medical Research Council in 1938, it is stated that the research in 1934-38 was limited to cases of cancer of the mouth, pharynx and larynx, as growths in these are situated in sites accessible to direct examination. From the beginning it was realized that the problem of successfully treating cancer is as much a physical as a clinical one, and a physicist and his staff have been in co-operation with the clinicians.

Stringent rules were drawn up to avoid undesirable effects on the workers and the patient from undue radiation. Charged condensers carried by each member of the nursing staff recorded the amount of radiation received by every nurse each day. There was no single case of damage by radiation to any member of the nursing staff or any of the research staff, and no accidental damage to any patient.

In the past a cause of failure in radium beam therapy has been the inability to assess with accuracy the dose delivered to tissues at some distance from the surface. A great deal of thought and work have been expended in the control and estimation of dosage. Blood examinations in both staff and patients were made at regular intervals and recorded. Every case was followed up and not a single patient was lost sight of.

An attempt was made to treat the primary growth through the lymphatic gland area, so that both might be influenced at the same time.

In many cases the enlarged glands disappeared and did not return. This was very encouraging, as the surgical treatment of infected glands in the neck is extremely difficult in carcinoma of the mouth.

The following conclusions were drawn as to the value of the treatment:—

(1) In cases where the growth is early and localized its complete disappearance can be expected.

(2) Where there is secondary involvement of the lymphatic glands in close proximity to the growth, the enlargement of the glands can also be made to disappear.

(3) Where both the primary growth and glands are in an advanced and inoperable stage, in a small proportion of patients the disease can be

made to disappear, and in a large proportion distressing symptoms may be relieved.

(4) When distant metastases have already developed, their growth will be progressive and inevitable, even though in the region treated the disease has been destroyed.

(5) Though it is too early to make definite pronouncements, it would appear that treatment of cancer of the mouth and throat by radium is at least as satisfactory as that provided by surgery or by interstitial radium therapy. It has, further, the great advantage that the results are obtained without mutilation of the patient.

The research staff are now making plans for investigating the treatment of carcinoma of the breast and of the mouth by means of a unit containing ten grammes of radium, which has never been attempted in this country. It will be of great interest to compare the results obtained with a ten-gramme unit with those obtained with a five-gramme unit hitherto used: the dosage will be doubled, the treatment time approximately halved and the biological response may be improved.

Another valuable investigation, plans for which are being made, would be a parallel trial of treatment with X-rays, done with the same accuracy and care as have been given to the radium work, in order to provide a basis for an unbiased comparison of the relative merits of the two methods.

In the Report of the Medical Research Council for 1937-38, just issued, it is stated that there is already looming in the distance the need for studying the therapeutic effects of neutrons and of temporarily radio-active substances, such as radio-sodium, now made possible by the discovery and development of the cyclotron by Lawrence in California. The earlier reports from the University of Berkeley indicate that the biological effects of neutrons are of even greater interest than those of X-rays and gamma rays; and it may be that in the special case of cancerous growth, and allied conditions, neutrons may be of outstanding importance. There is even the possibility that both radium and X-rays will be superseded by the cyclotron in the treatment of cancer by radiations and radio-active substances.

The Council state that Dr. F. G. Spear of their staff is at present in California working with Professor Lawrence on the biological effects of neutrons.

In assessing the facilities for treatment of cancer, the Chief Medical Officer of the Ministry of Health in his report for 1936 points out that it is important to find out the probable number of cases requiring treatment. It is comparatively easy to anticipate the number of cancer deaths as well as their distribution by organs which will occur in a given administrative

area within one or two years. It is next important also to know to what extent the number of deaths form a reliable guide in assessing the actual patients to be cared for. In the case of cancer of the breast the "natural duration"—in the absence of treatment—is about three years; there will, therefore be three times as many persons suffering from the disease as succumb to it in that year. A similar basis is used for the "accessible" group of organs for which data relating to the natural duration have been acquired; while for the remaining organs a duration of one year is assumed, an incontrovertible minimum. The estimation obtained in this way is a rough one; the effect is to indicate that the number of patients during a given year is 50 per cent higher than the number of deaths recorded for that year. In estimating the number of patients for whom full facilities for treatment are needed, cancer cases may be classed into two groups, (*a*) those in accessible sites and (*b*) those in internal organs. The number of cases in group (*a*), the treatable group, is in the region of 40 per cent of the total number of patients; the estimations just mentioned have been used in determining the adequacy of present facilities for treatment.

From the returns of a number of hospitals the proportion which cancer patients form of the total numbers admitted can be ascertained. It was found that cancer patients formed about 6 per cent in the hospitals with full facilities for treatment and about 2 per cent in the smaller provincial hospitals with no facilities other than operative treatment. Separate enquiries were made at those hospitals devoted entirely to the treatment of cancer and at those large general hospitals partially equipped for radium treatment. The actual numbers could be obtained for the former, but in the case of the latter it was necessary to take figures half-way between those having full radiation treatment and those with none at all. Of the actual cases so estimated it was ascertained that about, or rather less, than 40 per cent belonged to the treatable class.

The figures obtained for all the hospitals were then set against the total number of cancer cases of treatable sites estimated to be in existence during a year. The first deduction made from the figures was that the total number of cancer patients admitted to voluntary hospitals is about two-thirds of the total number of deaths, so that if the number of cancer patients is about 50 per cent higher than the deaths, not more than 40 to 50 per cent of all cancer patients are admitted. For the whole country it would appear that not more than a quarter or a third of all treatable cases are admitted to hospitals in possession of full means for radium treatment.

In order to remedy this state of affairs the Minister of Health feels satisfied—and in this he is supported by the views of the Radium Commission—that the position can only be met by a more active co-operation of local authorities. There should be complete co-ordination between the work of the voluntary hospitals and the local authorities. Treatment

would remain with and be carried out in the hospitals, the centres of X-ray and radium work, while the "field" work would rest with the local authorities. They would be concerned with advice outside the centres (with the help of the staff of the centres), with informing practitioners and the public, of the arrangements for helping and inducing patients to seek advice and treatment, with after-care and "following up." A number of local authorities are now practising one or other of these forms of co-operation, with results so favourable as to encourage their wider application.

In the matter of advice to the public, it is important that the notice of the provision of additional facilities should be in such a way as to encourage patients to seek early treatment. As regards obtaining treatment earlier the British Cancer Campaign through its Central Propaganda Committee is doing work devoted to this particular object.

The Radium Commission stated in their Seventh Annual Report that the facilities for treatment were inadequate, and as the estimates made by the Ministry corroborated this view it was deemed well to attempt a more direct assessment of the situation. Accordingly, an inquiry into the extent to which cancer patients receive treatment was made in 1938 by the Hon. Sholto Douglas for the Ministry of Health, and the results were published by the Ministry in Report 39 on Public Health and Medical Subjects, in December, 1938.

The report shows that patients with cancer can be divided into three groups. The first contains those patients who suffer from the disease in organs for which, under present conditions, treatment is impracticable, e.g., pancreas, œsophagus, lung, bronchus, etc. Such patients form about one sixth of the total cancer patients, and although a sensible proportion attend for advice at hospitals, little or nothing can be done for their relief.

The next group includes patients for whom treatment may be possible, provided they attend at an early stage and adequate facilities for treatment are available. This group comprises over half the total cancer patients, most of whom are affected in the stomach and intestinal canal. About half the patients attend for advice, but only about one tenth obtain any form of radical treatment.

The third group includes patients with cancer of those organs, viz. breast, uterus, skin, tongue and mouth parts, which are amenable to treatment by surgery and/or radiation at almost any stage of the disease, and constitutes one quarter of the total deaths from cancer. Nearly three quarters attend for advice at voluntary hospitals, and over half obtain treatment, but the proportion which attends for treatment at hospitals equipped with full facilities for modern treatment is small and er one quarter.

Clinical and other Notes.

A CASE OF OLD DISLOCATION OF THE SEMILUNAR BONE TREATED BY OPEN OPERATION.

By Major Alec McMillan.
Royal Army Medical Corps.

The patient, a female, aged 32, was injured in a riding accident on October 30, 1937. She was thrown from her horse, and fell on the dorsum of the right hand and forearm.

I saw her for the first time on December 6. Her wrist was then very swollen, all movements being limited and painful. Radiographs showed an anterior dislocation of the semilunar bone with rotation. On December 9 an attempt was made by manual traction under an anæsthetic to effect reduction. The method described by Böhler [1] was adopted, and strong traction in the long axis of the limb was made continuously for twenty minutes. The dislocation persisted, and a radiograph showed no change in the position of the bone.

Arrangements were made for the admission of the patient to hospital for an open operation. On December 13 under ether anæsthesia an incision four inches long was made along the ulnar side of the flexor tendons with its centre over the wrist-joint. The flexor tendons with unopened sheaths were pulled laterally, the ulnar nerve was seen medially, and the carpus exposed. The dislocated semilunar bone lay anteriorly; the remaining carpal bones were closely approximated to one another and to the radius and ulna so that no space remained for the replacement of the dislocated bone. There was no scar tissue present, and the cartilage-covered surfaces of the bone appeared normal. A Steinman's pin was driven through the olecranon process, and a second through the base of the metacarpals, and the arm placed in the screw-traction apparatus. Traction was slowly applied, its effects being watched through the wound. The carpus gradually separated from the radius, a very powerful force being required, and a space for the semilunar bone reappeared. An attempt was then made to press the dislocated bone back into position, but it was impossible to move it. Gentle force with various levers was applied without success. Finally, it was discovered that pressure on the semilunar bone and simultaneous relaxation of the screw-traction resulted in its readily returning into its normal position, and there appeared to be no tendency for recurrence of the dislocation. The wrist-joint was put through its full movements, the wound closed

by skin sutures, and a plaster applied from the axilla to the bases of the fingers with the elbow flexed to a right angle, the forearm in the mid-position between pronation and supination, and the wrist in very slight dorsiflexion. The plaster was retained for one month. Recovery was slow, but gradually became almost complete. At the time of writing—August 15, 1938—there is a slight limitation of flexion and supination, but function is very good. Radiographs show slight arthritic changes with

some rarefaction of the carpal bones, but these appearances are becoming less manifest.

The interesting features of the case were :—

(1) The considerable force required to separate the carpus from the radius so as to make room for the replacement of the displaced bone.

(2) The absence of any scar tissue or changes in the bones and their articular cartilages.

(3) The easy reduction of the dislocation by a combination of pressure over the bone and relaxation of the traction.

It appeared that it would have been possible to effect reduction of the

dislocation by the use of the screw-traction apparatus without making an open incision. In a similar case it would seem reasonable to fix the limb in the screw-traction apparatus, as described above; to apply traction with the limb under observation with the X-ray screen; and to attempt reduction by a combination of pressure over the semilunar bone and relaxation of the traction. Only in the event of failure of this method would it seem necessary to make an open incision.

I am indebted to Colonel J. T. Simson, Assistant Director of Medical Services, China Command, for permission to forward these notes for publication.

[1] BÖHLER, "Treatment of Fractures."

A CHEAP AUTOMATIC CONTINUOUS CHLORINATOR.

BY LIEUTENANT-COLONEL J. C. CHUKERBUTI, M.B., D.P.H., D.T.M. & H.LOND.
Indian Medical Service.

A.—REQUISITES.

(1) Two petrol or crude oil drums of the same dimensions (ordinary 5-gallon drums).
(2) A few inches of glass tubing.
(3) A few inches of rubber tubing.
(4) A metal or wooden clip.
(5) A piece of flat cork (floater).
(6) A piece of tin sheeting (contact plate).
(7) A regulating stop-cock with fine adjustment.
(8) A few inches of stout galvanized wire.

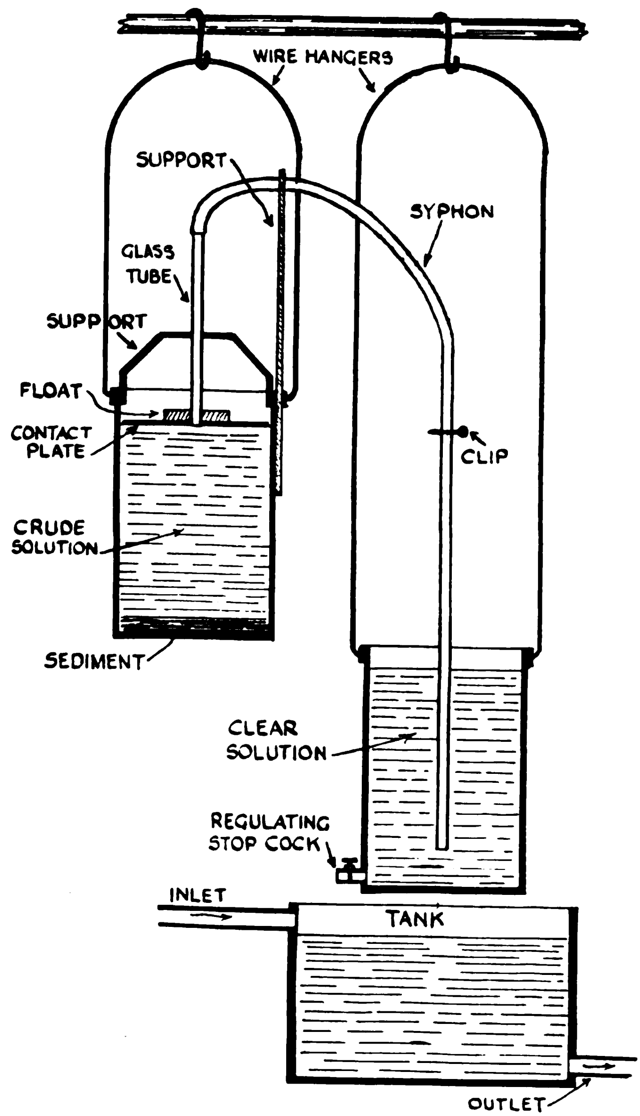
B.—GENERAL DESCRIPTION.

(*a*) *Method of Construction.*

(1) Fix to the underside of a flat piece of cork (floater) a round piece of tin sheeting (contact plate) so that when the floater is placed on the water the contact plate floats exactly on the surface level. Bore a hole through the centre of cork and plate and insert a piece of glass tubing which should stand vertically to a height of 3 inches above the top of the drum, while the lower end should be flush with the contact plate.
(2) Attach to the upper end of the glass tubing rubber tubing of a length equal to twice the height of the drum plus 4 inches.
(3) Bore a hole at the bottom of the second drum and solder the regulating stop-cock into the hole.
(4) Hang both the drums side by side by means of wire loops to the roof or to a hanger so that the top of the second drum is on a level with the bottom of the first drum.

(*b*) *Method of Working the Chlorinator.*

(1) Measure out the required quantity, ascertained by Horrocks' test, of the bleaching powder and put it into the first drum. Make a paste of the powder with just enough water and then fill the



drum with water up to 2 inches below the top. Stir the solution with a clean rod and allow the jelly-like flakes to settle at the bottom.

(2) Dip the rubber tubing along with the contact plate into water, drive out all the air in it and fill it with water. Put on the clip

at three-quarters of its length away from the contact plate. Now place the contact plate very carefully on the surface of the solution in the first drum and the other end in the second drum, so that no air can get into the syphon system. Undo the clip and syphon off the clear top portion of the solution into the second drum. The contact plate will keep to the surface as the level of the solution goes down in the first drum until the sediment is reached.

(3) Carefully manipulate the regulating stop-cock over the opening of the inlet pipe until the desired number of drops required per minute are counted by means of a watch so as to spread the whole solution by drop method over so many hours as will be required to fill the tank. Now open the sluice of the inlet pipe. The number of drops per minute will have to be calculated according to the number of hours required daily to fill the remaining portion of the tank when some water already chlorinated may be left over. Personal equation will probably play an important part at this stage.

(4) Clean out both the drums daily before use.

C.—Advantages.

(1) Uniform chlorination of all the water entering the tank achieved.
(2) Sediment in chlorine solution excluded by special syphonage system.
(3) Cost rendered trivial.
(4) Partial automatism secured.
(5) Continuity ensured.
(6) The materials, size and design alterable to suit the situation.
(7) Tried in large swimming baths fed by shallow wells worked by Persian wheels and found quite satisfactory.

FEVERS OF THE TYPHUS GROUP IN NORTHERN INDIA.

By Lieutenant-Colonel T. O. THOMPSON,
Royal Army Medical Corps.

The following note, which is based entirely on the memory of occurrences of some ten years ago, may be of interest in connexion with this subject and particularly in regard to the critical article by Blewitt which I have just re-read during a return voyage to India.

A brief account of the outbreak was given by me at the Congress of the Far Eastern Association of Tropical Medicine at Calcutta in the year following the outbreak.

As D.A.D.H., Meerut District, I received information that an epidemic

made to disappear, and in a large proportion distressing symptoms may be relieved.

(4) When distant metastases have already developed, their growth will be progressive and inevitable, even though in the region treated the disease has been destroyed.

(5) Though it is too early to make definite pronouncements, it would appear that treatment of cancer of the mouth and throat by radium is at least as satisfactory as that provided by surgery or by interstitial radium therapy. It has, further, the great advantage that the results are obtained without mutilation of the patient.

The research staff are now making plans for investigating the treatment of carcinoma of the breast and of the mouth by means of a unit containing ten grammes of radium, which has never been attempted in this country. It will be of great interest to compare the results obtained with a ten-gramme unit with those obtained with a five-gramme unit hitherto used: the dosage will be doubled, the treatment time approximately halved and the biological response may be improved.

Another valuable investigation, plans for which are being made, would be a parallel trial of treatment with X-rays, done with the same accuracy and care as have been given to the radium work, in order to provide a basis for an unbiased comparison of the relative merits of the two methods.

In the Report of the Medical Research Council for 1937-38, just issued, it is stated that there is already looming in the distance the need for studying the therapeutic effects of neutrons and of temporarily radio-active substances, such as radio-sodium, now made possible by the discovery and development of the cyclotron by Lawrence in California. The earlier reports from the University of Berkeley indicate that the biological effects of neutrons are of even greater interest than those of X-rays and gamma rays; and it may be that in the special case of cancerous growth, and allied conditions, neutrons may be of outstanding importance. There is even the possibility that both radium and X-rays will be superseded by the cyclotron in the treatment of cancer by radiations and radio-active substances.

The Council state that Dr. F. G. Spear of their staff is at present in California working with Professor Lawrence on the biological effects of neutrons.

In assessing the facilities for treatment of cancer, the Chief Medical Officer of the Ministry of Health in his report for 1936 points out that it is important to find out the probable number of cases requiring treatment. It is comparatively easy to anticipate the number of cancer deaths as well as their distribution by organs which will occur in a given administrative

area within one or two years. It is next important also to know to what extent the number of deaths form a reliable guide in assessing the actual patients to be cared for. In the case of cancer of the breast the "natural duration"—in the absence of treatment—is about three years; there will, therefore be three times as many persons suffering from the disease as succumb to it in that year. A similar basis is used for the "accessible" group of organs for which data relating to the natural duration have been acquired; while for the remaining organs a duration of one year is assumed, an incontrovertible minimum. The estimation obtained in this way is a rough one; the effect is to indicate that the number of patients during a given year is 50 per cent higher than the number of deaths recorded for that year. In estimating the number of patients for whom full facilities for treatment are needed, cancer cases may be classed into two groups, (*a*) those in accessible sites and (*b*) those in internal organs. The number of cases in group (*a*), the treatable group, is in the region of 40 per cent of the total number of patients; the estimations just mentioned have been used in determining the adequacy of present facilities for treatment.

From the returns of a number of hospitals the proportion which cancer patients form of the total numbers admitted can be ascertained. It was found that cancer patients formed about 6 per cent in the hospitals with full facilities for treatment and about 2 per cent in the smaller provincial hospitals with no facilities other than operative treatment. Separate enquiries were made at those hospitals devoted entirely to the treatment of cancer and at those large general hospitals partially equipped for radium treatment. The actual numbers could be obtained for the former, but in the case of the latter it was necessary to take figures half-way between those having full radiation treatment and those with none at all. Of the actual cases so estimated it was ascertained that about, or rather less, than 40 per cent belonged to the treatable class.

The figures obtained for all the hospitals were then set against the total number of cancer cases of treatable sites estimated to be in existence during a year. The first deduction made from the figures was that the total number of cancer patients admitted to voluntary hospitals is about two-thirds of the total number of deaths, so that if the number of cancer patients is about 50 per cent higher than the deaths, not more than 40 to 50 per cent of all cancer patients are admitted. For the whole country it would appear that not more than a quarter or a third of all treatable cases are admitted to hospitals in possession of full means for radium treatment.

In order to remedy this state of affairs the Minister of Health feels satisfied—and in this he is supported by the views of the Radium Commission—that the position can only be met by a more active co-operation of local authorities. There should be complete co-ordination between the work of the voluntary hospitals and the local authorities. Treatment

would remain with and be carried out in the hospitals, the centres of X-ray and radium work, while the "field" work would rest with the local authorities. They would be concerned with advice outside the centres (with the help of the staff of the centres), with informing practitioners and the public, of the arrangements for helping and inducing patients to seek advice and treatment, with after-care and "following up." A number of local authorities are now practising one or other of these forms of co-operation, with results so favourable as to encourage their wider application.

In the matter of advice to the public, it is important that the notice of the provision of additional facilities should be in such a way as to encourage patients to seek early treatment. As regards obtaining treatment earlier the British Cancer Campaign through its Central Propaganda Committee is doing work devoted to this particular object.

The Radium Commission stated in their Seventh Annual Report that the facilities for treatment were inadequate, and as the estimates made by the Ministry corroborated this view it was deemed well to attempt a more direct assessment of the situation. Accordingly, an inquiry into the extent to which cancer patients receive treatment was made in 1938 by the Hon. Sholto Douglas for the Ministry of Health, and the results were published by the Ministry in Report 39 on Public Health and Medical Subjects, in December, 1938.

The report shows that patients with cancer can be divided into three groups. The first contains those patients who suffer from the disease in organs for which, under present conditions, treatment is impracticable, e.g., pancreas, œsophagus, lung, bronchus, etc. Such patients form about one sixth of the total cancer patients, and although a sensible proportion attend for advice at hospitals, little or nothing can be done for their relief.

The next group includes patients for whom treatment may be possible, provided they attend at an early stage and adequate facilities for treatment are available. This group comprises over half the total cancer patients, most of whom are affected in the stomach and intestinal canal. About half the patients attend for advice, but only about one tenth obtain any form of radical treatment.

The third group includes patients with cancer of those organs, viz. breast, uterus, skin, tongue and mouth parts, which are amenable to treatment by surgery and/or radiation at almost any stage of the disease, and constitutes one quarter of the total deaths from cancer. Nearly three quarters attend for advice at voluntary hospitals, and over half obtain treatment, but the proportion which attends for treatment at hospitals equipped with full facilities for modern treatment is small and just over one quarter.

Clinical and other Notes.

A CASE OF OLD DISLOCATION OF THE SEMILUNAR BONE TREATED BY OPEN OPERATION.

By Major Alec McMillan.
Royal Army Medical Corps.

The patient, a female, aged 32, was injured in a riding accident on October 30, 1937. She was thrown from her horse, and fell on the dorsum of the right hand and forearm.

I saw her for the first time on December 6. Her wrist was then very swollen, all movements being limited and painful. Radiographs showed an anterior dislocation of the semilunar bone with rotation. On December 9 an attempt was made by manual traction under an anæsthetic to effect reduction. The method described by Böhler [1] was adopted, and strong traction in the long axis of the limb was made continuously for twenty minutes. The dislocation persisted, and a radiograph showed no change in the position of the bone.

Arrangements were made for the admission of the patient to hospital for an open operation. On December 13 under ether anæsthesia an incision four inches long was made along the ulnar side of the flexor tendons with its centre over the wrist-joint. The flexor tendons with unopened sheaths were pulled laterally, the ulnar nerve was seen medially, and the carpus exposed. The dislocated semilunar bone lay anteriorly; the remaining carpal bones were closely approximated to one another and to the radius and ulna so that no space remained for the replacement of the dislocated bone. There was no scar tissue present, and the cartilage-covered surfaces of the bone appeared normal. A Steinman's pin was driven through the olecranon process, and a second through the base of the metacarpals, and the arm placed in the screw-traction apparatus. Traction was slowly applied, its effects being watched through the wound. The carpus gradually separated from the radius, a very powerful force being required, and a space for the semilunar bone reappeared. An attempt was then made to press the dislocated bone back into position, but it was impossible to move it. Gentle force with various levers was applied without success. Finally, it was discovered that pressure on the semilunar bone and simultaneous relaxation of the screw-traction resulted in its readily returning into its normal position, and there appeared to be no tendency for recurrence of the dislocation. The wrist-joint was put through its full movements, the wound closed

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The interesting features of the case were :—

(1) The considerable force required to separate the carpus from the radius so as to make room for the replacement of the displaced bone.

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Indian Medical Service.

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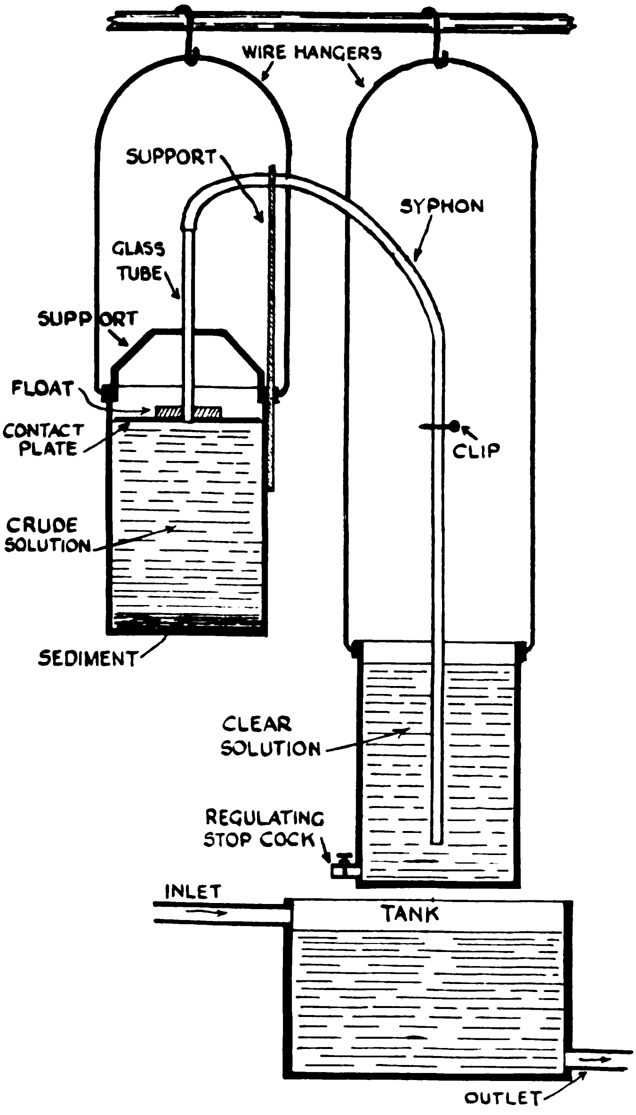

drum with water up to 2 inches below the top. Stir the solution with a clean rod and allow the jelly-like flakes to settle at the bottom.

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(4) Clean out both the drums daily before use.

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By LIEUTENANT-COLONEL T. O. THOMPSON,
Royal Army Medical Corps.

THE following note, which is based entirely on the memory of occurrences of some ten years ago, may be of interest in connexion with this subject and particularly in regard to the critical article by Blewitt which I have just re-read during a return voyage to India.

A brief account of the outbreak was given by me at the Congress of the Far Eastern Association of Tropical Medicine at Calcutta in the year following the outbreak.

As D.A.D.H., Meerut District, I received information that an epidemic

of tick fever had broken out in the Viceroy's Bodyguard at Dehra Dun, at which place this Guard was quartered during the hot weather months. Although we included their statistics in our returns, the Guard was then under medical charge of the Civil Surgeon and not under the military I.M.S. officers of the Station nor of the District.

However, to learn what was happening with a view to limitation of any infection in the Cantonment, I visited the area and by the courtesy of the Civil Surgeon saw all the lines, one case and the precautions being taken, together with the results.

Eventually there were in all seven cases with four deaths; an original case which died, then three others which died and then three more.

The last of the second group of cases was dying at the time of my visit and on the fourth day of his illness.

The outbreak was attributed to infection from the bites of ticks acquired in a certain valley to which the Guard took their horses for grazing. It was stated that dogs became heavily infested with ticks in this area. It was also stated that the horses got ticks on them and "that the men had probably been bitten there too."

On going carefully into the history of the cases we found that the first case, instead of giving a history of having been bitten in the tick-infested valley, gave a history of having reported sick four days after returning from leave. He had been four days on his way back from his home, which was in the Kashmir-Jammu State close to one of the main trade routes from the interior of Asia, and he had been to a festival a week before the return journey. This gives an incubation period of about fourteen days if the festival was the source of infection.

The next three cases had all started ten to twelve days after the first man had reported sick; but all gave a history of having grazed their horses in the tick-infested valley, as had all the Guard, but gave no definite history of tick bites.

The next three cases were in a group which occurred eight to ten days after my visit, and then there were no more cases.

It may be noted that in each case an incubation period of approximately fourteen days holds good.

On visiting the men's barrack-rooms it was obvious that the personal hygiene of the men was deplorable and much below that which would have been allowed in any of the units in the Cantonment, and that there were no arrangements for hot baths other than a degshie of hot water from the kitchen.

The precautions taken had been: (*a*) to counter the order permitting grazing in the suspected valley, (*b*) to "disinfect" the clothes of the patients and contacts and to "fumigate" the barrack-room.

A real cleansing of the whole place; disinfection by steam and adequate

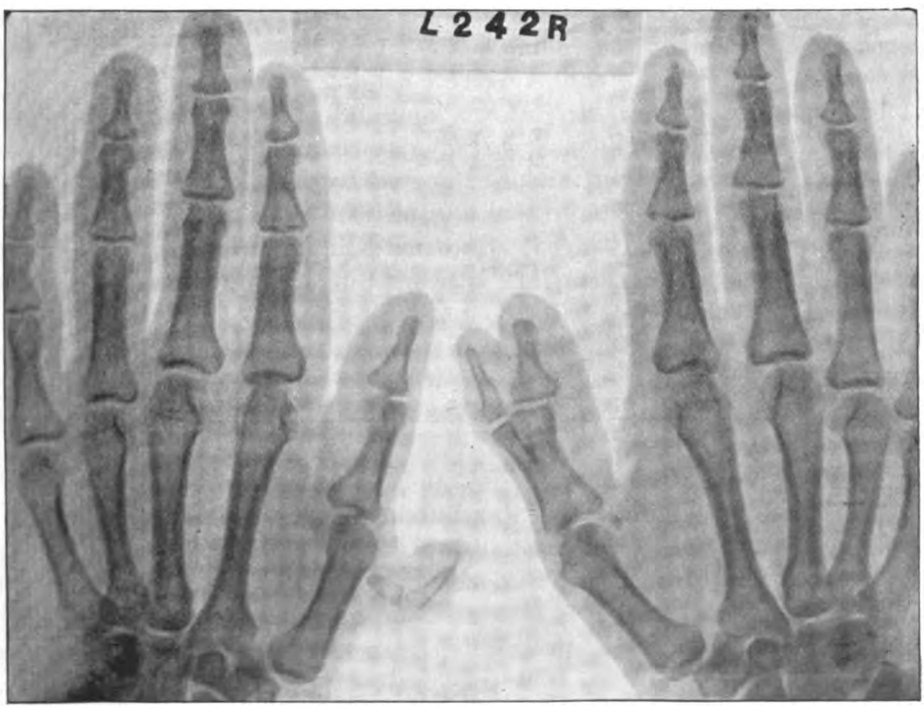
washing of all clothing of the whole Guard and provision of proper bathing facilities were advised and carried out.

Of the cases there was only the one dying patient in the Guard hospital at the time of my visit and we went in to see him. He was obviously desperately ill, appeared to have a definite rash and a high temperature. The first most noticeable feature of the case on closer examination was that on the outer side of the patient's sheet, apparently crawling diligently away from the patient, was a full-grown body louse.

POLYDACTYLISM, SYNDACTYLISM, OR BOTH?

By Lieutenant-Colonel K. P. MACKENZIE,
Royal Army Medical Corps.

The accompanying print, which is self explanatory, is sent for its clinical interest.



The patient, an Indian gardener of small stature, gave no history of any abnormality in his parents.

ALLERGY?

By Major W. Parsons,
Royal Army Medical Corps.

Major "X" of the R.A.M.C. telephoned to me at 10.45 on the night of August 22, 1938, stating that he had been stung by a wasp on the second finger of the left hand some thirty minutes previously and that he was fast developing a diffuse coarse rash all over the body and that he was driving up to the hospital for advice and treatment.

On arrival about fifteen minutes later the face was flushed and swollen and the skin over the body and limbs was becoming rapidly covered with an urticarial rash.

Indeed, so rapid was the spreading of the rash that it could be watched with the naked eye, involving areas not already affected.

It was evident on his arrival that not only was the patient seriously ill but rapidly getting worse.

The site of the sting was swollen, tense, pale and the hand on that side was perceptibly larger than the right.

He complained of headache, throbbing and fulness of his head and a sensation of burning and swelling of the whole body. He stated that the fingers and toes felt as if chilblains were coming out on them.

The pulse, which on his arrival was rapid, full and bounding, soon began to pass into one of a small and thready nature and finally became almost imperceptible and his general condition was very serious. There was no impairment of vision and no respiratory distress.

These symptoms developed within ten minutes of his arrival at the hospital and it was obvious that treatment of an immediate and drastic nature was called for.

A hypodermic injection of 4 minims of 1 in 1,000 adrenalin-hydrochloride was given.

The resulting improvement was as rapid and spectacular as had been the onset of the symptoms.

Within one hour he stated he felt quite all right.

The pulse had returned to normal, the rash rapidly subsided.

He was detained in the officers' ward for the night and soon fell off to sleep which was uninterrupted till the morning when he got up and not only drove home to breakfast, but was fit enough to play in a tennis match in the afternoon and to all outward appearances was as fit as he was before the accident.

About twenty-five years ago the patient had a very severe attack of diphtheria and was treated with large doses of anti-diphtheria serum.

The salient facts of this case are considered worth recording as illus-

trating the rapidity of the onset of an allergic state and the need of immediate treatment.

The case was far more serious than a simple urticaria from a wasp sting and was probably due to an acquired sensitivity.

An added point of interest in this case is the letter of Dr. F. O. Taylor of Coldingham in the *British Medical Journal* of August 27, 1938, which records his experience of a very similar case some few days previously in which the same treatment was adopted with similar rapid recovery.

In his case, however, the local reaction of the sting was more severe and prolonged.

I am indebted to Colonel A. L. Stevenson, A.D.M.S., East Anglian Area, and Lieutenant-Colonel O. R. McEwen, R.A.M.C., Officer Commanding Millitary Hospital, Colchester, for their permission to send the notes of this case for publication.

Travel.

KENYA.

By Lieutenant-Colonel F. S. GILLESPIE,
Royal Army Medical Corps.

(*Continued from page* 206).

January 21: We moved back to Nanyuki and stayed at "Sportsman's Arms," a delightful little hotel. On the way we fished the Naro Maro river, where I was the only unsuccessful one. We passed on the way another river, which had a board with the following notice, "Crown Lands Fishing—Burguret River—Beware of Rhino." I gather that it is quite a common occurrence for fishermen to be pursued by angry rhino on the banks. As there were other rivers near by with no such disadvantages we fished in them so I can give no first-hand information about the Burguret.

January 22: We fished the River Liki which runs through Nanyuki, a very nice river mostly passing through forest, with beautiful runs and pools. I had twelve fish, chiefly on a fly spoon, Ivy three, Ivor and Rita twelve between them. In the evening we drove up the slopes of Mount Kenya to a forest rest house from which we got a gorgeous view of the mountain with its forest-clad base, grassy slopes above, and then rocky rugged pinnacles partly covered with snow, rising to over 17,000 feet. From the house where we left the car we walked a mile or so to a rise from which we could get a good view of the forest glades, and we had hardly got there when a herd of buffalo came out to graze. We had a fine view of them through glasses.

January 23: Ivy and I got up early and went for a run of about 20 miles on the road to Thomson's Falls to try and get a photo of giraffe; lots of zebra and gazelle, ostrich and oryx, but no giraffe. After breakfast we fished the Liki again with little success. We saw a fine Colobus monkey and followed him for a bit through the forest to admire his fine black and white coat and white tail with hair about 6 inches long. After lunch we made our way back to Embu via Nyeri, completing the circuit of Mount Kenya. Nanyuki, which is on the railway, struck us as a good centre for anyone paying a visit to Kenya, several rivers within easy reach, lovely views of Mount Kenya, big game in great variety close by and a very nice hotel.

January 25: We fished the Thiba at a lower stretch where fish were reported to be bigger, but less plentiful. There was thunder overhead and not much moving; however, I realized an ambition long unsatisfied, a trout of over 2 pounds; he put up a great fight and nearly got in under the bushes beside the bank on several occasions.

January 27: We started off after breakfast for a visit to the Kenya Fly Fishers' Association Camp in Glen Tuso on N. Mathioya river, as guests of the Cox family, a delightful camp on the slopes of the Aberdares with a wonderful view and the river down at the bottom of a deep valley below us; this river is stocked with brown trout and provides excellent fishing at times, but they were not taking well when we were there.

January 28: Walter Cox got two nice fish of 2 pounds each before breakfast and put back another bigger one in poor condition. I toiled all day and only moved two before evening and then got a nice 1¼ pounder. Ivy moved a couple but got none. It was the nicest river we had fished, but for some reason they weren't taking—even Walter, who is a good fisherman, only got four all day.

January 29: Walter and I started at 7 a.m. and fished up-stream; he led me to the pool in which he got two yesterday and I was soon fast in a nice fish, 1 pound 14 ounces. I moved a couple more, but he had no luck so we climbed up the steep hill to a well earned "brunch," after which we returned to Embu.

January 30: We started off at 8 a.m. for Nyeri where Ivor had an urgent official call to make before starting on a long tour of visits and sightseeing. Nyeri is a pretty spot with a good 18 hole golf course and some good rivers within easy reach, also an hotel which has a branch in the forest slopes of Mount Kenya, called Tree Top Hotel, where visitors have rooms in a platform erected in large trees—all sorts of game can be seen from it. A lady we met had spent a night there recently and seen rhino and the rare giant forest hog. Ivor's business completed, we pushed on along the base of the Aberdares and over a plateau swarming with zebra, oryx, gazelle and ostrich to Thomson's Falls where we had tea and then

on over the rolling downs, rather like Salisbury Plain, with a gorgeous view back over Aberdares to Mount Kenya and forwards to the Great Rift Valley, that amazing cleft which stretches from the Red Sea down through to South Africa. Our goal was Nakuru in the bottom of the valley and as we wound our way down the hillside we could see the crater of Menengai, an extinct volcano, on one side, and Nakuru lake on the other side of the town. We were glad enough to get to the end of our journey of 230 miles.

January 31: We were up in good time and drove up to the top of Menengai to see the crater, a rather forbidding spot with a sheer drop into the crater, now well covered with scrub jungle. There was a fine view of the lake and even at a distance of 3 miles we could see that part of the lake had a broad pink border caused by the millions of flamingoes which congregate along its shallow edges. We went down to have a closer view of this amazing sight. The lake is impregnated with soda and very shallow and at certain parts the borders are a moving mass of these handsome birds with their pink wings. We pushed on at about 11 a.m. and stopped at Njoro to call on Colonel and Mrs. Kilkelly. He is a retired R.A.M.C. officer and came out to spend three months with his daughter and stayed seven years, having taken a house nearby. His son had been a patient in the Citadel at Cairo just before I left and I called to give his parents news of him. On from Njoro and through Molo to the top of Mau Escarpment, fine rolling grass country, split up into large farms growing wheat and running big herds of fine English cattle and sheep, we made another call this time on Alec Hemphill, a young brother of poor Robert who was killed so tragically a few years back. Alec has a very fine farm near Molo, a delightful bit of country at about 8,000 feet altitude. We got to Eldoret about 6 p.m. and were hospitably entertained by the D.C. there, Lindsey.

February 1: We set off soon after breakfast along a road where giraffe were reported and 10 miles out came on a herd of nine, which allowed us to approach quite close; in fact they seemed nearly as interested in us as we were in them and we stayed about half an hour watching and taking photos. Unfortunately my good camera with telephoto lens had had a fall and the shutter had struck work and I had sent it to Nairobi for repair. I got some quite fair pictures with an ordinary camera. We returned to Eldoret and left Ivy and Rita to shop, while we had a round on the local golf course, a very nice course too, except for a confounded river which meandered through it like an intoxicated snake and left the Gillespie family poorer by six balls in the course of two rounds. We took on Lindsey in the afternoon with our best ball and succeeded in defeating him, which cheered us. Dinner with Pailthorpe, the local R.M., who told me of a most unpleasant incident when he was mauled by a lion.

February 2: We started off for Tambach, intending to call at

Kapsiliat, the home of Mervyn Ridley, with whom we were to stay two days later, when about 3 miles from his house the main leaf of the front spring broke; most fortunately we were travelling quite slowly and on a a decent track. Had it happened later in the day on the Tambach road, the consequences might have been serious. The car, a Ford V8, was fitted with auxiliary springs fore and aft so we were able to drive on and leave the ladies and luggage at Kapsiliat, while we returned to Eldoret and got a new spring fitted. We got back at 5.45, loaded up and set off for Tambach, a former station of Ivor's where he had been responsible for planning and making a road down into the Kerio valley, a very backward part of the district. At Tambach we stayed with Howitt who ran a school for native boys, an excellent show, where they learned carpentry, building, blacksmith's work and basket work and farming. They seemed a happy, well-set-up lot and he said he could have taken many more if accommodation were available. Many of the boys preferred staying at the school to going home for holidays and had no difficulty in getting work when they left school. Tambach is on a shelf in an off-shoot of the Rift Valley. There was a wonderful view from the house down into the valley.

February 3: We started off after breakfast to see the valley road of which we had heard so much during its construction. Ivor could get no official sanction or money to begin it so he had made a start with prison labour after having plotted out the lines himself and had them vetted by an engineer friend. He had done a great deal of the preliminary blasting and had a most exhausting time in the heat walking down, surveying and cutting tracks through bush, blasting rocks and overseeing native workmen who knew nothing of road making and then climbing back a couple of thousand feet home again in the evening. When he had about 3 miles finished he asked his Provincial Commissioner to come and have a look at it; the P.C. said little but went back and pulled the necessary strings at headquarters and obtained the necessary sanction for the work to start. The road was a most hair-raising piece of engineering with sheer drops of hundreds of feet into the valley and we were devoutly thankful that the front spring had chosen the previous day to break. The inhabitants of the valley, Nandis, I think they were, were armed with bows and arrows, and wore very little clothes; some wore none, very suitable for the climate, which was intensely hot and dry, and we were glad enough to get back to Tambach 2,500 feet up for lunch.

February 4: We returned to Kapsiliat and spent the afternoon fishing the Moiben river, very narrow and overgrown. I had no success but Ivor got a few small ones. The ladies joined us at 6 p.m. and we went out in a punt on the dam which had been erected to provide power for a mill and electric light plant for the farm; once it got dusk we had good fun with the rainbows which started to rise all around us. They don't rise to

natural fly in most places so it was all the more fun when they did here. There was a certain amount of criticism of the ladies' skill which evoked some rude retorts; however, they caught fish which was the main thing. We caught no big ones, but a dozen or so small ones gave us a lot of fun and we didn't tear ourselves away till it was pitch dark. A drink, a bath and dinner were all equally welcome and we slept like logs.

February 5 : We set off for Nakuru through Eldoret and I picked up my good camera which had been sent up from Nairobi. Off to Nakuru taking a different road after climbing Mau Escarpment down through Eldama Ravine. When within 8 miles of Nakuru we saw a large bush fire ahead, and thinking we might get past before it crossed the road we ran up close to it only to find that we could not pass in safety. Ivor then started to turn but as the road was narrow we soon realized this was impracticable and started to back out. The flames came along at a most alarming speed and were roaring along 15 feet high with a high wind behind them. We only just got clear with a couple of minutes to spare, an exciting experience. After watching for some time we realized there was no hope of getting through and made a detour of 15 miles to Nakuru. After tea we went out to a camp just outside the town, where Mr. and Mrs. Leakey were excavating ancient lake dwellers' huts and were shown their finds, chiefly skeletons and ancient knives, scrapers and arrow heads made of volcanic glass which is quite common in the Rift Valley; Leakey had skinned and cut up a Thomson's gazelle with one of the knives to prove its efficacy.

February 6 : We went on 40 miles on the main Nakuru-Nairobi road, and a shocking road it was, to stay with Mr. and Mrs. Heath on Lake Naivasha in a house they had taken furnished for a year, while they built a new house 5 miles further along on the lake shore. The house they occupied was a most attractive one on the edge of the lake with a wonderful flower and vegetable garden. The soil is volcanic ash and seems to grow anything that is put into it. After tea we went along to see their new house in course of construction and it made us wish we could follow their example and settle in this little gem of a place, with lake and hills all round. While we were there the Imperial Airways Flying Boat from Kisumu landed on the lake as it was too late for it to make the trip to Mombasa.

February 7 : We were awakened by the flying boat making an early start and before breakfast strolled round the garden and were taken over to the neighbouring house of Mr. and Mrs. McCrae who were away. They had a wire enclosure in front of the house in which were two cheetah. We were told they were quite tame, and that Mrs. M. used to take them out on a lead. While we were watching them their attendants came along and brought their morning meal, a big lump of kongoni meat. They brought this into the enclosure and the cheetahs got down to it at once. I was trying to get a photo when Ivy and Rita suggested that I should go inside. I went in

and was just getting into a nice position for a snap when the male cheetah, evidently thinking I had designs on his breakfast, made a rush at me, fortunately he stopped within a few feet and I made a dignified departure. The photo turned out to be as shaken as I was. After breakfast we drove round the lake to a bay which was reputed to be a sure find for hippo. Unfortunately just before our arrival one had been disturbed by a Mr. Evans who was in camp there with his wife taking photos of game. He told some of his experiences. One night he was awakened by his wife who said that there was a lion just outside; like many a husband, he was going to treat the tale of a midnight marauder a bit light-heartedly; however, he looked out and sure enough there was a lioness sniffing about the verandah, so he got his rifle quietly from the bedside and fired; she departed a short distance evidently badly hit and was joined by five companions who prowled about just outside till daybreak and then departed with the wounded one, which he followed up and killed. The lions had thoroughly investigated the kitchen tent and carried off the aluminium coffee pot which was found some distance away chewed out of all recognition, except for its steel handle. We went on a few miles to see a lake in an extinct volcano crater, a beautiful spot with trees coming down to the water-side all round, we looked down from the crater edge at the lake about 300 feet below. The water was a uniform light green colour which gave a curious effect. We picked up some pieces of volcanic glass, I believe obsidian is its correct name, and there were large pieces lying about fused on to pieces of rock. The whole area is volcanic and in many places there are jets of steam coming out of the hillsides. We left after lunch for Nairobi about 70 miles off and passed through Limuru at tea time and stopped at Brackenhurst Hotel for tea—we had time for a game of golf on the hotel course, a very pleasant 9 holes with grass greens; I found the uphill holes a bit trying at 8,000 feet altitude. We got into Nairobi for dinner.

February 8 was spent shopping and I bought a couple of spoons and minnows and some gut substitute and swivels to deal with some of the larger trout and particularly one which had twice broken me. In the evening we went out on the Athi Plains game reserve and I got some nice photos of zebra and wildebeest with the telephoto lens.

February 9: We returned to Embu and found the accumulated mail of ten days awaiting us and were kept busy answering letters the next day.

February 12: I had made up a couple of stout casts, soaked them well and fixed on my new spoon, a red and silver 1 inch affair with two single hooks and was itching to try it out, so we set off once more for the Thiba. I first of all tried the fly and lost two in one pool, one a nice fish of 1 pound or more, got one of ¾ pounds and then got to a deep pool under a big waterfall. I very soon had a beauty on the big spoon and he put up a great fight, a lovely 2-pounder. He was soon followed by another of 2 ounces

less, he followed the spoon across the pool three times before finally falling a victim to its charms. All this time I had been keeping the best pool for a titbit and eventually got down to it, a deep corner just above a rapid with a bed of rushes around a rock. I had several casts before I eventually got the spoon to come past the rock where I knew the big one lay, and what a thrill when I felt my strike go home; I was glad of a stout cast as I didn't dare let him over the rapids, and it was a ding-dong struggle for a good bit before he eventually came to the surface and I suppose fully five or six minutes before I got him into the net, a record for me, 3¼ pounds in lovely condition. Ivy came along just as I had him out so we sat down and had lunch. We then went down below the falls and I put Ivy to fish a nice pool as near the falls as we could get. Not being satisfied with her method of casting, I said "Stop a moment, and watch me. You just swing it out underhand like this and then draw in slowly, and then you have a fish on", which I had, a 1¼ pounder. I was lucky to escape personal assault for I had done exactly the same on the Liki and in each case it was the only feeding fish in the pool. It came on to rain very heavily soon after and we got soaked and had a most unpleasant drive home. I had a dry coat and pullover and put them on, but after a few miles the road was so slippery that I had to put on chains. A couple of local natives passing got a shock at seeing a "bwana" clad only in a pair of shorts wrestling with chains. I wiped myself fairly clean with wet grass and put on my dry clothes again and got home safely after cutting away part of a tree which had fallen across the road.

(*To be continued*).

Current Literature.

McINTOSH, J., and WHITBY, L. E. H. **The Mode of Action of Drugs of the Sulphonamide Group.** *Lancet*, February 25, 1939.

The authors conclude from their experiments that:—

(1) Sulphonamide drugs do not stimulate leucocytic or phagocytic activity.

(2) Sulphonamide drugs do not affect the speed of production or the quality and quantity of specific immune bodies.

(3) Sulphonamide drugs, both *in vivo* and *in vitro*, are not instantly active, and there is a quantitative relationship between the effective dose of the drug and the number of bacteria affected.

(4) Sulphonamide drugs are active on highly virulent organisms and those in the logarithmic phase of multiplication; they are inactive on "rough" organisms.

(5) Sulphonamide drugs are not simple germicides; they probably act by neutralization of some metabolic function or enzymatic activity.

KRAMER, Captain, German Air Medical Service. **Experiments on the Deficit of Vitamin C in Sufferers from Parodontal Disease.** *Der Deutsche Militararzt*, December, 1937.

In *Der Deutsche Militararzt* of December, 1937, Captain Kramer, German Air Medical Service, attributes the high incidence of acute ulcerative gingivitis and stomatitis in the German Army to a deficiency of vitamin C from lack of fresh fruits and vegetables in the diet.

In spite of appropriate local treatment by dental officers and a rigorous oral hygiene, many cases did not respond to treatment and others frequently relapsed. Such cases were further characterized by lassitude and pains in the limbs and joints.

An all-fruit diet was found to produce a rapid cure for the local and general condition, and relapse did not occur provided a regular quantity of fresh fruit and vegetables was supplied in the diet.

Experiments were undertaken in the administration of graduated doses of synthetic vitamin C, in the form of tablets of "Redoxon" (Roche), and satisfactory results were obtained in each of eighty-six treated cases. During the administration of "Redoxon," local dental treatment was stopped and ordinary diet taken.

The author considers that there is a widespread and unsuspected deficiency of vitamin C in the population and the fighting services which predisposes to gingivitis, and suggests that the most convenient and economical remedy is synthetic vitamin C in tablet form.

S. H. WOODS.

MILAM, D. F., & KUSCH, E. **Observations on *Plasmodium knowlesi* Malaria in General Paresis.** *Southern M. J.* 1938, v. 31, 947-9. [Summary appears also in *Tropical Diseases Bulletin.*]

The most commonly employed agent in induced malaria is *P. vivax*, but some white persons are partially or completely immune to it, and negroes seem also generally to be refractory. It may also be difficult to maintain the strain if there are insufficient patients. A solution of the difficulty was offered when Knowles and Das Gupta successfully inoculated volunteers with a strain of monkey malaria now known as *P. knowlesi* as it can be kept going in rhesus monkeys, and in human beings responds readily to quinine. Van Rooyen and Pile in England and Ciuca in Rumania have reported favourably on it, but Nicol (Epsom) does not regard it as equal to *P. vivax*.

The authors treated with *P. knowlesi* 35 patients, of whom 15 had previously undergone mild attacks of malaria or had resisted infection with *P. vivax*. Six of the 35 were coloured patients and responded only mildly or not at all, while all of the 29 whites reacted. The incubation period, after intravenous inoculation with 1 to 5 cubic centimetres whole blood, varied from three to thirteen days (average 5). The average attack

took a quotidian course for about ten days, after which it declined gradually to normal without intervention. In one case the course had to be interrupted because of severe symptoms, and in five quinine was used for mild relapses. These may occur as long as four months after the first infection. The effects on the patients' G.P.I. are summarized, but a comparison with those of malaria by *P. vivax* is impracticable. The authors say that some value of the *P. knowlesi* malaria as a therapeutic agent was demonstrated in 48 per cent of their cases.

They conclude that the strain has a limited application; the moderate course often terminating spontaneously is an advantage, though one must be on the lookout for occasional severe infections. L. W. HARRISON.

Reprinted from "Bulletin of Hygiene," Vol. 14, *No.* 1.

GREENE, R. A., & BREAZEALE, E. L. **The Use of Swabs Impregnated with Ascitic Fluid in the Laboratory Diagnosis of Gonorrhœa.** *J. Lab. & Clin. Med.* 1938, v. 23, 1211-13.

The authors report "extremely satisfactory results" in the culture of gonococci from discharges by using swabs soaked in ascitic fluid. The swab, prepared in the usual manner, is sterilized in its test-tube by hot air, and the wool-end is then dipped in sterile ascitic fluid and replaced in the tube, after which the upper end of the tube, with stopper in position, is dipped in paraffin which has been autoclaved. They prefer "Difco" ascitic fluid, which is supplied in 10 cubic centimetre ampoules. If "Difco" is not available, ascitic fluid is preserved by the method of Geiger thus: "Permit the ascitic fluid to stand on ice for over-night, and decant if necessary. Add 0·25 per cent chloroform and incubate twenty-four hours, shaking frequently. Test for sterility and preserve on ice as long as it is satisfactory and does not become too alkaline."

The authors incubate the impregnated swab before planting and find that growths from it contain few Gram-positive organisms; investigations are being made to discover if ascitic fluid inhibits other than the Gram-negative or prevents production of dissociated forms of other organisms which may resemble the gonococcus in staining properties.

L. W. HARRISON.

Reprinted from "Bulletin of Hygiene," Vol. 14, No. 1.

GREENBLATT, R. B., TORPIN, R., & PUND, E. R. **Extragenital Granuloma Inguinale.** *Arch. Dermat. & Syph.* 1938, v. 38, 358-62, 2 figs. [22 refs.]

Extragenital granuloma inguinale has been reported by many workers, of whom the authors quote fourteen, and its incidence appears to have been 6 per cent of all cases. The sites mentioned here include the nose, mouth, throat, lips, cheek, neck, thigh and back of hand. The authors

have studied forty-five cases of granuloma inguinale in the past three years, and two of them were extra-genital, one being on the lips and the other, which is reported in detail, on the neck. They say that the affection should be diagnosed only when Donovan bodies are found in the smear or the characteristic cell is seen in sections. Donovan bodies may be overlooked in smears because they are too scanty on the surface, and the search may be more successful in smears of the deeper parts of the lesion. They may also escape notice because of their pleomorphism, as in the immature, non-encapsulated forms they may resemble other organisms. In case of failure to find Donovan bodies sections of biopsy material stained with Delafield's hæmatoxylin and eosin or by Dieterle's silver technique for demonstration of *Sp. pallida* (*Arch. Neurol. and Psychiat.*, 1927, v. 18, 23) will demonstrate the pathognomonic cell and the characteristic inclusion bodies. In this connexion reference is made to an article by Pund and Greenblatt on the specific histology of granuloma inguinale in *Arch. Path.*, 1937, v. 23, 224. L. W. HARRISON.

Reprinted from " Bulletin of Hygiene," Vol. 14, *No.* 1.

CUÉNOD, A., & NATAF, R. Nouvelles recherches sur le virus trachomateux. [**New Investigations of the Virus of Trachoma.**] *Arch. Inst. Pasteur de Tunis.* 1938, v. 27, 284-97. [11 refs.]

The authors are well known for their discoveries of the probable importance of lice in the causation of trachoma. The demonstration of rickettsia in trachomatous tissue, and the cultivation of rickettsia in lice, is due to their work. They have in this paper recorded further work on these organisms. They have found it possible to inoculate the chorio-allantoic membrane of eggs developing in incubators, and to pass the virus through a series of eggs. The virus brings on changes in the membrane, congestion, thickening and adhesions to the neighbouring parts. It has proved very fatal to the embryo; even more fatal than typhus virus. They find in the chorio-allantoic membrane of eggs thus infected rickettsoid elements of very small size. These may be found in the eggs of the later inoculations from egg to egg. One of the chief difficulties in this examination they found to be the frequence of secondary infection of the trachoma material by fortuitous organisms. Many of their early experiments were spoiled by such sepsis.

They found that material from infected eggs of the third passage could excite inflammation in the testicle of a guinea-pig, and the tissues showed the presence of bodies similar to the rickettsia. Material from the testicle excited in eggs changes like those already described. Preparations made from guinea-pigs inoculated with mouse typhus show changes in the cells and elements which closely resemble those bodies which the authors have described in trachoma, under the term rickettsoid. They think that all

things go to show a close relation between rickettsia and epithelial inclusions. It is a fact that after inoculation with typhus the tunica vaginalis of guinea-pigs shows, before the appearance of rickettsia, inclusion bodies, which are no longer to be seen when the rickettsia are fully developed. They hold that in the development of the same micro-organism there may be two different forms in the different stages of growth.

They have recently investigated the action of cyanide of potassium on the growth of rickettsia; they find that it seems to be very inimical to their growth and in solution of 1 in 3,000 to inhibit it almost completely. They suggest that it may be found useful clinically.

HAROLD GRIMSDALE.

Reprinted from " Bulletin of Hygiene," Vol. 14, *No.* 1.

Reviews.

HYGIENE : A MANUAL OF PUBLIC HEALTH. By J. R. Currie, M.A.Oxon, M.D.Glasg., D.P.H., F.R.C.P.Edin. 1938. Pp. 324; 34 figures, 15 tables. Edinburgh: E. and S. Livingstone. Price 15s. net, postage 6d.

This volume will fill a definite gap in the guides to knowledge for medical and hygiene students and as a refresher for those who need to revise details of this subject.

A textbook of this size and with descriptions clearly set forth and marshalled in an order suitable for the ordinary student and practitioner of medicine has been definitely needed for some time.

Professor Currie has provided in this volume an admirable sequence of instruction which makes perusal a pleasure. The intention is to give to the general student a true outline with sufficient detail to form a real working picture of hygiene as the general practitioner may view it.

The arrangement gives priority to the social aspects of the subject and the progress of the individual through his natural existence.

Section I deals with a general survey, but after this Sections II to VII follow the individual from his pre-natal existence to his old age and cause of death. Sections VIII to XVI cover public health administration and the subjects of food, water, housing and its concomitants of lighting, warming and ventilation, and the disposal of refuse. Hospitals and personal hygiene are dealt with in Sections XVII and XVIII with many useful items and data recorded and advice tendered.

Communicable diseases and their vectors form the subject of the concluding Sections, with a final Section on International Hygiene.

The index appears adequate and the illustrations are clear and sufficient.

A much fuller table of foods and their calorie and vitamin values might with advantage have been added in Section X to Tables 5 to 8 showing a full range of foods and made dishes. An easy reference page of this nature is not infrequently in demand by erudite laymen educated by advertisement propaganda.

In view of the tendencies of modern house builders, it is pleasing to note the definite opinion that "eight feet is too low a height for a habitable room."

It is also pleasing to note that terminal disinfection is treated in a rational manner, and soap and water are allotted their full function. But in disinfection by steam we think that the essential value of "downward displacement" should be more fully stressed.

In the water section it is surprising to note that chloramine and bleaching powder are dismissed in three and four lines respectively, seeing that these water-treatment agents, which were introduced by our Army, have since then been adopted in military and civil practice throughout the world. The student for the D.P.H. well knows the amount of detail which may be required by his examiners and the qualified practitioner may not infrequently be confronted with questions on the use of bleach and chloramine.

For water treatment by domestic filters, we think that too much stress cannot be laid on the need for frequent cleansing and suggest that the more modern all-metal filter should have been included.

In the paragraph on cerebrospinal fever a note on the results of sulphonamide treatment might be made as has been done in that on gonorrhœa.

The section on insect disease vectors is particularly clear and useful, but we think that paraffin oil on the water produces more effect than a mere asphyxiation of the mosquito larva.

The final section with its air raid paragraphs and notes on war gases, though brief, is clear and good.

The book appears likely to be a success, and, as a textbook of medium size, fills a real need and can be recommended for this purpose.

MINOR MEDICAL OPERATIONS: For Senior Medical Students and Recently Qualified Practitioners. By Kenneth Harris, M.A., M.D. Cantab., F.R.C.P. Lond., and Edith Harris, M.D., B.S. Lond., D.P.H. Eng. 1938. Pp. x + 198. London: H. K. Lewis and Co., Ltd. Price 7s. 6d. net.

In this small manual the authors have brought together information on the usual medical procedures that may have to be undertaken by any medical man. The methods of exploration of the chest, the indication of an

artificial pneumothorax and bronchography by the injection of lipoidol, are described. Vivisection, blood grouping, blood transfusion and paracentesis of the pericardium are amongst the subjects dealt with in a chapter on procedures in the cardiovascular system. The routine methods of investigation of the alimentary, urinary and nervous system are similarly dealt with. Diagrams illustrating the various apparatus employed in such examinations are included.

CATALOGUE OF LEWIS'S MEDICAL AND SCIENTIFIC LIBRARY. Part I.—Authors and Titles. 1938. Pp. 550. London: H. K. Lewis and Co., Ltd. Price 16s. net. To subscribers, 8s.

Another edition of this excellent book, which is revised up to the end of 1937, has now appeared. It is, as usual, a mine of information invaluable to all members of Lewis's own lending library, and to anyone studying medical research. To medical librarians, it is recognized as a desk "bible."

PSYCHE AND THE PHYSIOLOGISTS, AND OTHER ESSAYS ON SENSATION. By E. G. Dru Drury, M.D., B.S.Lond., D.P.H.Durh. 1938. Pp. viii + 104. London: H. K. Lewis and Co., Ltd. Price 5s. net.

This little book consists of some six papers read to various bodies in South Africa, principally lay. The theme of these addresses is, speaking generally, the mechanism of sensation and thought processes as revealed by the research of physiologists and its application to psychology. Perhaps for the reason that these papers were to be read to an audience the book is written in a somewhat abrupt and uneven style, but this frequently serves to arrest the reader's attention on the author's terse and striking expressions. Dr. Dru Drury is to be congratulated on his book, which is clearly the product of a medical practitioner of wide interests and experience. Interest in the subject matter of this book is very keen at the present time, and the book will appeal strongly to medical officers and others who are interested in the processes by which the nervous system functions.

Correspondence.

THE EFFECTS OF MECHANIZATION ON EVACUATION.

TO THE EDITOR OF THE "JOURNAL OF THE ROYAL ARMY MEDICAL CORPS."

SIR,—I was most interested in Lieutenant-Colonel T. B. Nicholls' article in the October, 1938, number of the JOURNAL OF THE ROYAL ARMY MEDICAL CORPS on "The Effects of Mechanization on Evacuation" but, with all due deference to him, I can foresee on a great many occasions the complete chaos ensuing in mobile warfare if the M.D.S. is abolished and attempts are made to evacuate wounded direct from the R.A.P. or A.D.S. to the C.C.S.

I was also surprised to learn that direct evacuation from the A.D.S. to the C.C.S. had proved a success in France in the Great War. During the R.A.M.C. Officers' tour of the French battlefields in 1934, under the direction of Lieutenant-General Sir James Hartigan, one of the things that impressed me most was his description of the first attempt at direct evacuation to the C.C.S. in one of the bigger battles. General Hartigan took us to the exact site of his C.C.S. and described in detail the arrangements made. Very shortly after the commencement of the battle, the motor ambulance cars started to arrive; the wounded men were sorted out, and urgent surgical cases sent immediately for operation. This was ideal for a short time, but as more and more wounded arrived, it became impossible to cope at sufficient speed. General Hartigan said he would never forget the sight which greeted him on going out to the road—a line of ambulance cars, loaded with wounded, stretching from the C.C.S. entrance to the horizon.

I agree with Colonel Nicholls it is a great pity that the light motor ambulance car is not in War Establishments. The present six-wheeled ambulance cars in use in England and India are uncomfortable for the patient, and not nearly so handy over open and sandy country as the light four-wheeler.

Taking Colonel Nicholls' conclusions in the order in which he has given them :—

(1) One cannot afford to cut down the equipment of an A.D.S. Admittedly, in a war of open movement in a European country, the A.D.S. may be little more than a collecting station, but what about an A.D.S., for example, in mountain warfare in India? The organization and establishment of an Indian Field Ambulance and a Field Ambulance on Home Establishments, although not exactly the same, are, of necessity, very similar. The former may, at any time when necessity arises, be

employed overseas, and therefore it is essential to keep its organization similar to the latter.

(2) We are taught that future wars are going to be wars of rapid movement, and that one may expect a divisional front of seven miles or more. Let us presume that before a battle the C.C.S. is situated even as far forward as eight miles behind the so-called front line, what will the distance be after one to two hours time, if the attack is successful? Possibly twenty to thirty miles. I cannot picture the A.D.M.S. being able to control evacuation over such an enormous area, especially as Colonel Nicholls himself states that any roads available are certain to be one mass of mechanized transport, moving to the front, and probably blown sky-high as well. It is reasonable to suppose that casualties might even be hours in motor ambulance cars before reaching the C.C.S., and many of them would require resuscitation, etc.

(3) The more one sees of present training and tactics, the more it appears obvious that the field ambulance, for all practical purposes, must become a brigade unit. This also particularly applies to mountain warfare on the North-West Frontier, where it is essential at the beginning of operations to detail a complete field ambulance to a brigade, which will remain with it until the end of the operations.

In our own medical training we still get too much Great War tactics shoved down our throats. For example, such formations as Walking Wounded Collecting Posts are still talked of, though these are surely relics of the days when a Division held a frontage of 1,000 yards?

(4) It would appear sounder to stick to the present organization, and evacuate the wounded to the M.D.S. which is in the brigade area, and there to remove their equipment, take particulars, give resuscitation, and sort out and send back first the urgent cases requiring early treatment at the C.C.S. If the Field Ambulance can clear the battlefield of wounded more rapidly than the C.C.S. can deal with them, it is all the greater argument against the abolition of the M.D.S. If the C.C.S. staff is increased it becomes more immobile than ever, which is unsound in mobile warfare, and especially so if the M.D.S. is abolished.

I agree with Colonel Nicholls that one standardized Field Ambulance, capable of being modified for different conditions, should be sufficient. Presumably this is bound to come. During the Waziristan Operations, 1936-38, a Field Ambulance has had to change from a combination of pack (mule) and M.T. (normal establishment) to all M.T., all mule, all camel, and all A.T. cart basis within the space of a few months.

(5) If motor ambulance cars are required for a C.C.S., cannot cars from the ambulance car company be detailed for this duty?

(6) I agree that the nomenclature "field ambulance" is often confusing to officers of other units, and I have on several occasions had a

request from a Staff Officer for the loan of a "field ambulance." The best cure for such a request is to deliver a field ambulance, complete, at place and time requested. He is not likely to use the wrong nomenclature again.

To obviate confusion, the term "motor ambulance car" should always be used in full when issuing verbal or written orders.

I am, etc.,
T. W. DAVIDSON,
Major R.A.M.C.

Peshawar.
December 23, 1938.

POST-GRADUATE COURSES.

TO THE EDITOR OF THE "JOURNAL OF THE ROYAL ARMY MEDICAL CORPS."

DEAR SIR,—On page 109 of the editorial on "The State of the Public Health" in your issue of the Corps Journal for February, 1939, one reads the following :—

> A great extension has been made for the scheme of post-graduate courses for medical practitioners. Under this larger scheme, which will apply to practitioners irrespective of where they practise, it is intended that they shall be able to obtain a free course once in every five years. Within specified limits not only will the fee of the course be paid, but also travelling and subsistence costs and the cost of the whole-time *locum tenens* where one is required.

Many of your readers will no doubt have been impressed on reading the above, and wonder if something of the kind could not be arranged for the medical man in the Services. The Ministry of Health have come to realize that in order to offer the public the best advice that the medical profession can provide medical practitioners must be kept constantly abreast of the frequent and important advances which are continually being made by medical research.

At the present time an average of eight years passes before the young officer in the R.A.M.C. undergoes a course and examination in professional subjects. At that time he comes to realize only too well what strides medicine and surgery have made since he qualified, and even with regular reading of the medical journals he finds it difficult to make up lee-way. Following the Senior Course no further refresher course is provided for the rest of the officer's service, a period probably of about twenty years.

Other branches of the Service are constantly being given refresher courses in various arms and being taught new improvements, and what applies to them should surely apply to the Medical Services, where the changes are no less rapid and probably infinitely more important.

Now that the short service system is under trial and there is the

possibility of a certain number of young officers shortly returning to civil life, it would be unfortunate if the impression were to get about that the R.A.M.C. was in any way lagging behind the rest of the profession in the important matter of keeping abreast of modern thought and discovery. It is suggested, therefore, that in order to bring the Medical Services into line with our civilian colleagues, and with the combatant branches of the Services, periodic courses should be held, which for the general duty officer should embrace all those subjects likely to be found most useful by a staff surgeon or officer in medical charge of troops and families during his daily work. Obstetric emergencies of diseases of women and children should certainly find an important place.

Such a procedure would, I feel sure, soon justify itself in attracting in increasing numbers the best type of young medical man.

Crookham Camp,
Aldershot.
March 15, 1939.

I am, etc.,
W. J. OFFICER.
Major, R.A.M.C.

Notice.

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A free issue of twenty-five reprints will be made to contributors of Original Communications and of twenty-five excerpts in the case of Lectures, Travels, Clinical and other Notes, and Echoes of the Past.

Reprints or excerpts, additional to the above, can be furnished on payment if specially ordered at the time of submission of the article for publication.

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No. 5. May, 1939. Vol. LXXII.

Journal OF Royal Army Medical Corps

IN ARDUIS FIDELIS

ISSUED MONTHLY

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Vol. LXXII. May, 1939. No. 5

Journal
of the
Royal Army Medical Corps.

Original Communications.

THE PROTECTION OF MEDICAL ESTABLISHMENTS BY SIGNS.

By Colonel E. M. COWELL, D.S.O., T.D., D.L., F.A.C.S.

CONTENTS.

Introduction.

In view of potential attack from the air, the protection of Medical Establishments by signs is of extreme importance at the present time, in all areas where the Medical Services may be engaged, in the field, on lines of communication and at the base, whether at home or abroad.

Fast, long-range bombers can carry a ton of high explosive, incendiary or gas bombs. These machines will fly at a height of from 15,000 to 20,000 feet, a height from which it is difficult to pick out and operate on a definite target with perfect accuracy.

Public opinion demands some form of protection by signs at any rate for home hospitals, which may contain civilian patients. The question of Protection in the Field must be left to the General Officer Commanding the Force, who may not wish to reveal the disposition of any of his troops to the enemy air reconnaissance.

Report on the Interpretation, Revision and Extension of the Geneva Convention of July 27, 1929.

A valuable paper with the above-mentioned title was published as Document No. 11*a*, by the Sixteenth International Red Cross Conference held in London in June, 1938.

Observations of the Swiss Military Department and a report by Major-General Schickelé of the French Army Medical Service are published in Appendix 11.

General Schickelé insists on the use of the colours red and white prescribed by Geneva, and the use of the cross as defined by the Geneva Convention. The dimensions suggested are a cross with a total width of 25 metres and arms 3 metres across. This he considers visible from 4,000 metres.

The Swiss Report points out that emblems 5 by 5 metres "as employed at present" are inadequate, also that larger emblems should *not* be spread over the ridge of a roof, since these cannot be recognized in time by aircraft even when flying at low or medium altitudes.

General Schickelé admits the usefulness of accessory and additional means to facilitate the observation of the Red Cross, but does not venture to make any suggestions.

In the course of the present article the use of the letter H will be recommended as a ground sign, additional to the Red Cross.

Protection of Field Medical Units.

Experience in Abyssinia has shown that the Geneva Cross cannot be relied on for protection against air attack.

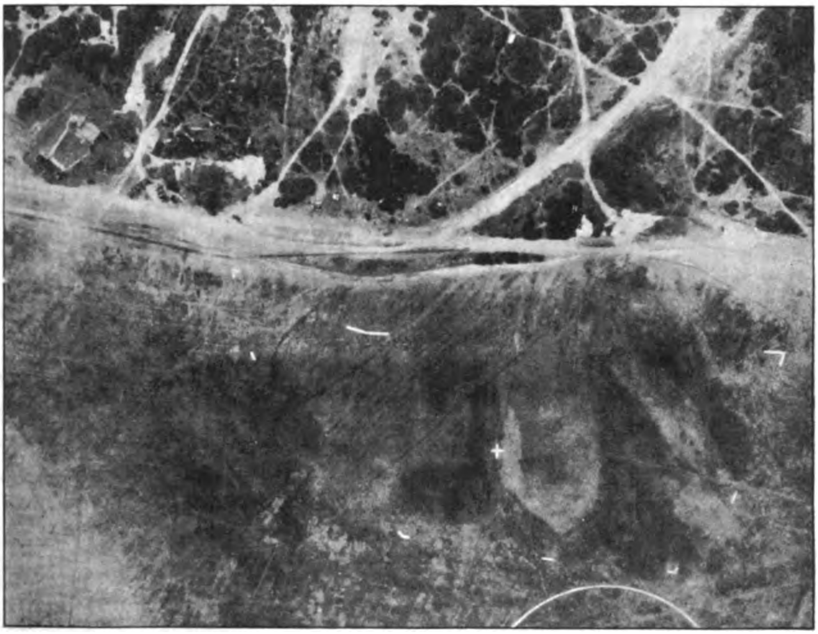
Concealment of troops previous to any attack is extremely important in modern warfare. The General Staff will not give away the disposition of their troops by well-marked medical establishments. Advanced dressing stations and main dressing stations will, therefore, in future rely for a measure of protection on the following points: (1) Choice of situation as far as possible from Artillery formations and definite targets such as crossroads, dumps, etc. (2) Taking all possible advantage of natural cover such as woods, etc. (3) Artificial camouflage to protect temporary buildings or tents. (4) Parking of vehicles in the shadow of trees; and (5) Instruction of the personnel to remain still in the shade without exposing their faces on the approach of aircraft.

In an exercise on concealment at Farnborough Aerodrome, the 131st Field Ambulance, T.A., covered their tents with branches of trees, parked their vehicles amid the gorse and kept the men in the shade. I was taken up as an observer and although I knew exactly where to look, failed to see signs of the unit even at 3,000 feet (*See page* 291).

Stretcher bearer parties should be taught to estimate the height of

approaching aircraft. From 10,000 feet and over they will not be distinguishable whatever they do. If the machines are lower the men should put their stretcher down and lie down themselves. In open fields groups of bearers look like cattle or sheep grazing. If there is time to get into the shadow of hedges or woods concealment is obviously more successful. The difficulty of distinguishing enemy from friendly aircraft is so great that the only safe course is to regard all machines as hostile and act accordingly.

These remarks do not apply to the putting up of directing signs to field medical units. Well-shaded illuminated signs should be placed on the ground for night work. These may be improvised by placing a hurricane lamp in a suitably prepared packing case. Direction signs are painted on suitable blue-tinted semi-transparent material. Arrows painted with luminous paint, mounted on small posts, are useful.



PROTECTION OF CASUALTY CLEARING STATIONS AND BASE HOSPITALS.

By the kind co-operation of the 615 Auxiliary Squadron, R.A.F., I have recently been able to make observations myself on the visibility of the Red Cross and the use of auxiliary signs.

Photographs taken at 5,000 feet show that a Geneva Cross 25 by 25 feet can be distinguished without much difficulty.

Direct observation, however, of crosses 30 by 30 feet improvised by

spreading white sheets and red blankets on the ground, when made from a height of 10,000 feet, shows: (1) It is difficult to distinguish the sign at all. (2) The red colour can no longer be distinguished. (3) The sign is confused with small flat-topped out-buildings or sheds.

From 15,000 feet it is doubtful whether even the large crosses suggested by General Schickelé can be accurately distinguished by a fast bomber in time to avoid dropping his bombs near the hospital buildings. An accessory sign such as the letter H made out of hospital sheets laid on grass or other suitable background with vertical lines 70 feet long, and the horizontal 30 feet, was tried out. This was picked out 3 to 4 miles away at 5,000 feet oblique view and could still be seen at 15,000 vertical observation.

Quite apart from the visibility of any sign that may be agreed upon, the question of accuracy in bombing arises and what is more important, proximity to a definite target such as a railway line, gasworks, factory, etc.

From the height of 20,000 feet at which enemy bombers might be expected to operate, various factors will come into play to induce the crew to off-load their bombs as soon as possible after arriving in the neighbourhood of their objective. It is unlikely that careful observation will be made to seek hospital signs, and even if recognized it is doubtful whether careful aim can ensure that medical establishments are not hit.

A recent instance in China was described to me verbally, where a large Red Cross 60 by 60 feet, supported on poles to ensure its visibility, failed to secure protection for a large hospital building which was heavily bombed from a height of 500 feet.

At the present time the International Red Cross Committee is considering the recognition of certain areas as neutral zones to be left immune from bombing attacks, " Villes Sanitaires."

Conclusions.

(1) Forward medical units should be prepared to rely on camouflage for protection.

(2) The medical staff should be responsible, after consultation with A, for the location of forward units as far away as possible from definite targets.

(3) Medical officers in charge of advanced dressing stations and main dressing stations should possess some practical knowledge of field engineering to enable them to render buildings proof against splinters, incendiary bombs and gas.

(4) As regards medical establishments on lines of communication and at the base, a very large Geneva Cross must be laid out on the ground as

suggested by General Schickelé. In addition, as an accessory sign a letter H is suggested.

(5) All buildings used should be rendered proof, as far as possible, against incendiary bombs and protected against splinters and gas. Covered slit trenches in the hospital grounds may be advisable in certain cases.

(6) At night protection is best afforded by a black out.

ADDENDUM.

Since this paper was written the author had an opportunity of visiting Republican Spain before the cessation of hostilities.

The remarks on forward medical units were confirmed—even the motor ambulances were camouflaged and their little red crosses were hardly visible.

As regard hospital buildings in towns, no attempt was made to use any protective signs.

It was felt that the display of any emblem might invite attack.

INTRODUCTION TO HONG KONG AND SHANGHAI EMERGENCY, 1937.

By Colonel H. H. BLAKE, O.B.E.
Then A.D.M.S. China Command.

How often all of us have made the remark " It ought to be written up for the Journal," and have not done it. I remember that very remark being made as we were watching destruction north of the Soochow Creek in September, 1937.

In June 1938, when at Millbank I was asked by a senior officer to write about the Shanghai emergency. On thinking it over I decided to ask my two colleagues Major Tibbs and Lieut.-Colonel Galloway to write about their experiences. Their articles have just been forwarded to me by Colonel J. T. Simson, A.D.M.S.

The article by Major Tibbs on the situation and how it was dealt with is open to criticism, but the important points I wish readers to keep in mind are that Hong Hong is a long way from home—that reinforcements take a long time to come out. Quick decisions had to be made, and release of reinforcements is a difficult question when the situation is unstable. Moreover, the resources in Hong Kong in the way of personnel, other than practitioners, are very small and still in process of organization.

I should like to take this opportunity of thanking both officers for their loyal response to my request, and at the same time all other officers who were serving in China Command at this time—no one could have been better served. I was greatly indebted for our late Director General's support and for his several D.O. letters to me, which were full of guidance and good advice.

THE MEDICAL ORGANIZATION OF THE SHANGHAI EMERGENCY, 1937.

By Major F. C. TIBBS, *Royal Army Medical Corps.*
D.A.D.H. China Command.

On August 13, 1937, information was received that in consequence of the outbreak of hostilities in Shanghai, the situation there was uncertain and reinforcements might be required at short notice.

The normal garrison of Shanghai is one battalion. On August 14, 1937, a battalion was dispatched from Hong Kong, followed two days later by a second.

The following medical personnel and equipment were sent with these two battalions to supplement the normal peace medical establishment in Shanghai :—

Personnel : 3 M.O.s (including one Lieut.-Colonel to act as S.M.O. vice

the S.M.O. who was unable to return from leave owing to the disorganization of communication); 11 other ranks R.A.M.C.

Equipment: The medical equipment of a 40-bedded hospital, one ambulance car and 50 stretchers.

Thus within a few days of the occurrence of a state of emergency, the strength of the garrison at Shanghai had been raised from one to three battalions, and such medical personnel and equipment as could be spared had been sent there.

In the meantime, the hospital in Shanghai had been ordered at short notice to vacate its quarters in Central Road, and had hurriedly taken up emergency quarters in the County Club, whence it was moved a few days later to the International Recreation Club nearby.

The medical reinforcements already sent were, however, insufficient, and since it was anticipated that probably four battalions in all might be required in Shanghai, an appreciation of the situation in Shanghai from the medical point of view was made on this hypothesis, due regard being paid to the needs of the Shanghai Volunteer Corps, a local body of troops who were mobilized at the time.

In this appreciation it was estimated that the daily sick-rate in Shanghai was likely to be about 0·7 per cent of strength and that beds for approximately 400 patients would be required.

The reasons for this estimate were as follows:—

(1) Experience of previous disturbances in Shanghai had shown that high admissions for intestinal disease, malaria and V.D. were to be expected.

(2) The present hostilities being on an unprecedented scale, an unusually large influx of refugees was likely which would tend to increase the risk of epidemic disease.

(3) Cholera had already assumed epidemic proportions elsewhere in China.

(4) The malaria season was just about due to commence.

It was therefore proposed to send further medical reinforcements from Hong Kong on the first available boat. Thus, on August 22, 2 Medical Officers, 1 Quartermaster, 4 members of the Q.A.I.M.N.S., and 10 Other Ranks embarked for Shanghai, making a total medical reinforcement for that station since the beginning of the disturbance of:—

6 Officers (includes one acting S.M.O., and one Quartermaster.)
4 Q.A.I.M.N.S.
21 Privates.

On August 19 the situation was reviewed in the light of information received from Shanghai since the commencement of the emergency.

In this review the medical needs not only of Shanghai but also of Hong Kong were considered. At the latter station a severe epidemic of cholera was in progress, and the steadily increasing overcrowding of the

Colony with refugees was fraught with a grave risk of epidemic disease. Moreover the possibility of local disturbances could not be overlooked.

For these reasons it was deemed advisable to increase temporarily the number of beds in the Military Hospital, Hong Kong, in addition to the hospital expansion in Shanghai already in progress.

The main conclusions of this review were as follows :—

(1) Although there were then sufficient personnel to staff 200 beds in Shanghai, it was anticipated that 300 to 350 would be required if the strength was further increased.

(2) The Military Hospital in Hong Kong should expand as required.

(3) To relieve congestion in the Shanghai hospitals an ambulance transport capable of accommodating 20 lying and 30 sitting cases was required to ply between Shanghai and Hong Kong.

(4) The total number of hospital beds required at Hong Kong and Shanghai during the emergency was estimated at 700.

(5) The following medical personnel, additional to those already sent, were still required :—

9 Officers, R.A.M.C.
10 Q.A.I.M.N.S.
86 Other Ranks, R.A.M.C.

(6) A Field Hygiene Section was also required in Shanghai.

By the end of August one British battalion had arrived from Singapore, with 1 Medical Officer and 9 Other Ranks, R.A.M.C. The remainder of the reinforcements arrived a few days later.

To deal with the proposed increase of the Hong Kong garrison by one battalion of Indian troops, it was decided to expand the Indian Wing of the Combined Military Hospital, at Kowloon, by 32 beds. (This later proved barely sufficient.)

Arrangements were made to take over barrack rooms for the purpose, and the necessary alterations were carried out.

India was asked to send the following additional staff :—

1 Medical Officer.
1 Sub-assistant Surgeon.
9 Indian Hospital Corps (ambulance orderlies, cooks, bhistis and sweepers).

The bulk of the extra equipment required was available locally. A few articles which could not be obtained in Hong Kong were supplied from India.

On September 5, one Indian battalion arrived with 1 Medical Officer and 1 Sub-assistant Surgeon as regimental medical establishment; and by the middle of September all the additional personnel had reported for duty.

This Indian battalion was at first accommodated under canvas, and suffered a good deal from the inclement weather experienced during the

latter part of the year. Owing to the overcrowded state of Hong Kong it was some time before suitable quarters could be found for them.

Preparations were now made for the reception of the reinforcements from the United Kingdom.

Pending transfer to Shanghai, R.A.M.C. reinforcements were to be accommodated partly at Bowen Road Military Hospital and partly in tents at Combined Military Hospital, Kowloon.

Temporary accommodation for Sisters was found at the Government Civil Hospital Sisters' Quarters, some two miles from the Military Hospital, which was kindly placed at our disposal by the Colonial Government, free of rent.

The ordnance equipment for 80 beds was sent to Shanghai, and Ordnance were asked to hold in readiness equipment for 100 more beds.

Early in September a B.I. steamship was placed temporarily at the disposal of the military authorities as an ambulance transport.

A trooping party of 1 officer and 6 other ranks, R.A.M.C., was detailed for duty in this ship, and the necessary equipment provided from local sources.

This transport brought 25 sick from Shanghai on September 13, but as events turned out it was not found necessary to make any further use of this method of evacuation.

Meanwhile temporary establishments were drawn up for the hospitals in Shanghai; the S.M.O. was told the number of beds to be equipped, and the situation as regards reinforcements explained to him.

On September 22, the A.D.M.S. visited Shanghai to settle outstanding questions.

On October 8, the reinforcements arrived from England. The Field Hygiene Section departed for Shanghai the same day, and the medical personnel required to bring the Shanghai hospitals up to the emergency strength was despatched by a cruiser on October 15. The rest of the reinforcements remained in Hong Kong. Some were used to staff the expanded military hospital; the remainder were held in readiness to proceed to Shanghai should the garrison be reinforced to the scale originally contemplated.

Thus, by the third week in October, the total requirements in personnel and material had been fully met, and the enlarged hospitals both in Shanghai and Hong Kong had been brought up to their emergency establishments.

The situation, however, was eased when the excursions and alarms of war passed beyond the confines of the Settlement a few weeks later, and it was not found necessary to send further reinforcements to the north.

During his visit to Shanghai at the end of September the A.D.M.S. had decided that, subject to the concurrence of Command, the Skin Hospital should be transferred from Jessfield Park to the International

Recreation Club and that the Military Hospital should return to its old quarters in Central Road as soon as this could be arranged.

This move was carried out during the second week in November.

By January, 1938, it was considered that the Field Hygiene Section was no longer required, and War Office approval was obtained for the return of this unit and its equipment to the United Kingdom by the first available troopship, less certain personnel still required for the disinfecting centre and area sanitary duties. This unit sailed for home on February 11.

In February, 1938, it was made known that the number of battalions in Shanghai would be reduced to two at the end of the trooping season.

A reduced establishment for Shanghai was therefore prepared and the S.M.O. was instructed that the International Recreation Club would be evacuated by January 31, after which date all patients and personnel would be accommodated at 24, Central Road.

The medical staff in Shanghai was accordingly reduced to this establishment, and surplus personnel and equipment were returned to Hong Kong as occasion offered.

Those no longer required were despatched overseas in accordance with War Office instructions, but it was decided to retain in Hong Kong the bulk of the reinforcement from United Kingdom until the situation returned to normal. There they still remain.

Note by Late A.D.M.S.

Major Tibbs has made no mention of his visit to Shanghai previous to mine—I sent him up with the second reinforcements. His report was most valuable; he gave me a picture of what was happening, as the situation was changing almost daily. This information was laid before the G.O.C., China Command, who gave me authority to make whatever arrangements I thought best from the hospital and financial point of view. A financial adviser, in a disturbance of this kind, is of immense assistance if you have a good case.

One point of difficulty was that of deciding where our 700 beds were to be. The situation in Shanghai was extremely difficult, as the Japanese and Chinese had destroyed the civil hospitals north of the Soochow Creek. There were no available buildings left in Shanghai and therefore the ambulance transport might be of the greatest help. However, as the article points out, the situation eased and we were able to get on with our hospital programme.

The sick rate of 0·7 per cent eventually proved too high: 0·5 per cent was reached. Fortunately malaria did not develop, as the season was hot and dry and unsuitable for the carriage of malaria infection.

SHANGHAI EMERGENCY, 1937.

By Lieutenant-Colonel R. W. GALLOWAY, D.S.O., M.B.
Royal Army Medical Corps.
S.M.O., Shanghai Area.

Introduction.

A short account of the Shanghai emergency may be of some interest to readers of the Corps Journal because of the unusual conditions under which the British Forces had to operate; and also because several interesting sanitary problems presented themselves for solution during the emergency. The conditions prevailing at the commencement of the Sino-Japanese hostilities and the sequence of events insofar as it affected the medical services will first be described; and secondly, the more important sanitary measures which were adopted.

Modern war in and around a crowded city of over five million inhabitants must be an unpleasant affair at the best of times, but it is much more so when such a city is inundated with thousands of starving refugees, and when cholera and dysentery attain epidemic proportions.

Within a week the garrison was increased to three times its normal strength, and owing to the disposition of the defence sectors the troops were unavoidably in close contact with the poorest of the Chinese. This occurred at the height of the fly season and the risk of epidemic gastro-intestinal disease was therefore very real.

The risk of disease was by no means the only one. Fierce fighting was taking place on the perimeter and at many points our troops were holding posts within ten yards of a full-blown modern battle. Casualties were more than likely. The safety of the troops guarding the Settlement and of the inhabitants really depended entirely on the accuracy of modern weapons of war and on the skill of the belligerents. That this was not at all times to be trusted was demonstrated in a terrible manner by the accidental bombing incidents and the many stray shells which took toll of life in the Settlement. Our troops were subjected to many of the risks of war without being at war.

In these circumstances it was difficult, if not impossible, to venture an accurate estimate of the hospital accommodation likely to be required. The number of battle casualties would depend on luck to a large extent, whereas the sick rate would be governed by the effectiveness of the sanitary measures adopted, and especially by the degree of protection it was possible to provide against fly-borne disease. It is sufficient to say that the extra staff and hospital accommodation asked for by the A.D.M.S. —Colonel H. H. Blake—proved to be entirely adequate without being excessive.

CONDITIONS AT THE COMMENCEMENT OF HOSTILITIES.

Tension in Shanghai had naturally increased since the outbreak of hostilities in North China, but until a few days before the event nobody seriously thought that this city would be involved in the fighting. The incident which touched off the explosive mixture occurred on the afternoon of August 9 when Sub-Lieutenant Isao Oyama and a Japanese sailor were shot dead on Monument Road by the Chinese Pao An Tui—Peace Preservation Corps!

From this moment events proceeded apace and by August 12 Shanghai was virtually surrounded by between 20,000 and 30,000 Chinese troops, and the perimeter of the Settlement was manned by the International Defence Forces, including the Shanghai Volunteer Corps. The following day, August 13, negotiations having failed, the first shots were fired and by evening artillery was in action on both sides.

The British Garrison consisted of the 2nd Battalion The Loyal Regiment which had to man a large part of the Sector, erect sand-bag posts, barbed wire defences and also provide the necessary guards and patrols. The British Military Hospital was equipped for sixty-two beds and was situated near the junction of Nanking Road and The Bund. The normal staff was 5 medical officers, 5 sisters and 42 other ranks. Actually there were only four medical officers as I was on leave in North China and was not recalled until August 15, and did not reach Shanghai until after the evacuation of the British Military Hospital.

The following day, August 14, came to be known as "Bloody Saturday." On the afternoon of this never-to-be-forgotten day Chinese planes, whilst endeavouring to hit the Japanese flag-ship "Idzumo," dropped bombs on two of the most crowded areas of the Settlement and caused the most appalling carnage. Two of the bombs fell on Avenue Edward VII and killed over 1,050 Chinese and Foreigners and wounded many more. Other bombs fell on the Palace Hotel and Nanking Road within a few hundred yards of the British Military Hospital. About 150 were killed and many more wounded. A number of the latter were dressed in the British Military Hospital.

These incidents caused a good deal of alarm and nobody really knew what would happen next. The Settlement could no longer be considered safe for foreign women and children and their evacuation to Hong Kong commenced a few days later.

EVACUATION OF THE BRITISH MILITARY HOSPITAL AND ARRIVAL OF RE-INFORCEMENTS.

There were rumours that the Chinese intended to try to come through the Settlement in order to take the Japanese in the rear. This would have meant that the British Military Hospital would probably have come

under direct shell-fire. On account of this the site of the hospital was considered to be unsafe and at midnight orders were received from British Military Headquarters to evacuate the hospital at once. Within two and a half hours all patients had been transferred to the Country Club, some two miles farther west.

The accommodation in the Country Club, which incidentally continued to function as a club, was unsatisfactory and could only be looked upon as a temporary shelter until a more suitable building could be found.

The loss of the permanent hospital right at the beginning of the emergency was a very great handicap, the effect of which was felt all through the hostilities. It enormously increased the difficulties of medical administration at a time when bed accommodation had to be rapidly increased to six times the normal.

The Garrison was soon to be trebled and owing to conditions already described it was estimated that 350 to 400 beds would be required. Possible buildings were few and far between owing to the tremendous influx of refugees and the arrival of re-inforcements for the International Forces. Accordingly we were lucky in obtaining the International Recreation Club building, which could accommodate about 140 to 200 beds and the staff; or 200 to 260 beds if the staff were billeted out. This would serve in the meantime, but a building for a further 100 beds would be necessary later.

On August 19 the venereal division and the hospital staff were transferred to the International Recreation Club, and the rest of the hospital followed on August 26. Only stores were left in the Country Club until such time as room could be found for them in the new building. During this period of transition two battalions arrived from Hong Kong, and also reinforcements in medical officers, nursing staff and other ranks, R.A.M.C. Stores for the expansion of the hospital were arriving almost daily and things were for the time being rather chaotic.

Two aerial torpedoes were dropped on the Settlement about 1 p.m. on August 23. The first on the U.S. Godown, just behind Hamilton House where the British Consulate General had taken up temporary quarters. Fortunately it failed to explode. The second fell a few moments later on the Sincere Co's Emporium in Nanking Road and exploded with great violence, damaging the Wing On Store opposite. The casualties were numerous—173 killed and 549 wounded. Most of the dead were blown into small pieces which were later carried away like butcher's meat on open lorries.

No more demonstrations were needed of the terrible effects of modern aerial bombs on a densely populated city. Although the number of persons killed and wounded in these bombing incidents was extremely high, yet the actual damage to buildings was not great. Had any of

these bombs chanced to land on billets or camps occupied by the troops our casualties must have been enormous; fortunately this did not happen. The effects of deliberate and systematic bombing of a city such as Shanghai would be too terrible to contemplate.

The 2nd Battn. The Royal Welch Fusiliers had arrived on August 17, and were quartered in the Grand Stand of the Race Club. They took over from the Shanghai Volunteer Corps the duty of defending "B" Sector. The sanitary conditions in this sector were appalling and a more detailed description is given later in this article. The sketch map shows the position of the defence sectors.

BRITISH DEFENCE SECTORS IN SHANGHAI 1937

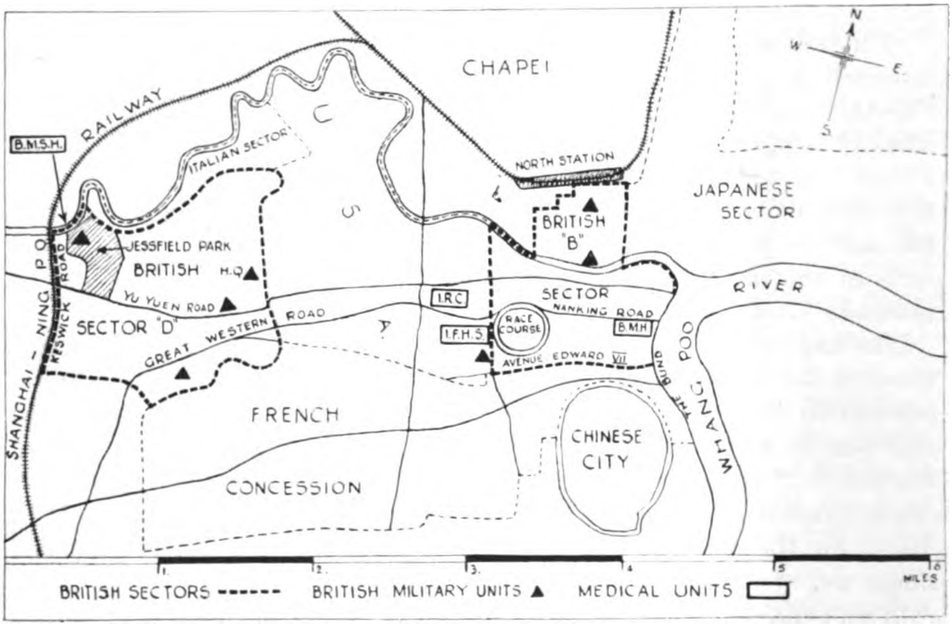


FIG. 1.

The 1st Battn. The Royal Ulster Rifles arrived the following day and were billeted in the Yu Yuen Road Schools. They took over the right half of "D" Sector along the Soochow Creek. The emergency British Force was now complete and numbered approximately 2,400.

The International Recreation Club building required a good deal of structural alteration to make it suitable as a hospital. Bath-houses, latrines, coal-sheds, etc., had to be erected in the very small yard available, and the R.E. had to exercise considerable ingenuity to fit them all in. One of the verandahs was converted into an excellent operating theatre with two tables, and for these two remarkably good operating lamps were

made of tinned iron sheet by the R.E. The sketch (fig. 2) shows the manner in which they were constructed. They did noble work and gave a shadowless light, almost up to "scialytic" standard. Should the necessity for improvising operating lamps ever arise in the future this design may be recommended. The cost was approximately six shillings each.

Although the International Recreation Club could accommodate up to 260 beds most of the wards were large and this rendered the segregation of different classes of case difficult. Normally our infectious cases were sent to the Civil Isolation Hospital, but this had been evacuated owing to the hostilities, and as the temporary civilian hospitals were full to overflowing we had to make provision for treating our own infectious cases.

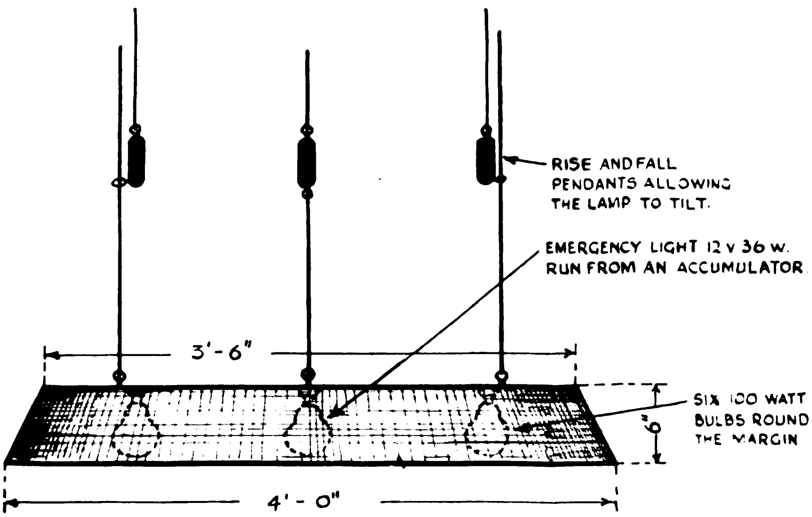


Fig. 2.—Improvised operating lamp. Made of tinned iron sheet. Six 100-watt bulbs round the margin. One emergency light in centre, 12 volt, 36 watt. Four 1-inch ventilating holes round each lamp socket.

Cholera and dysentery were rapidly attaining epidemic proportions amongst the Chinese and as the fly season was at its height it was decided to increase the hospital accommodation by establishing a separate venereal and skin hospital of a hundred beds and to billet the R.A.M.C. personnel outside. This would give us a total of 360 to 400 beds. Accordingly, on September 4, a venereal and skin hospital of 100 beds was opened in the permanent hutted camp at Jessfield and the personnel of the British Military Hospital were billeted in the Union Jack Club.

The Civil Disinfestation Station, where normally we sent blankets, kit, etc., for disinfection was now in the firing line and a temporary centre had to be established with the aid of an old Thresh and a few Lelean sacks.

On September 13, the first of a series of five cases of cholera occurred amongst the troops, as a result of eating ice-cream bought from a Chinese hawker in direct contravention of orders. The entire Garrison had been inoculated more than fourteen days before: in spite of this one of these cases died. The occurrence of these cases is illustrative of the fact that inoculation is not an absolute protection against a massive dose of cholera vibrios. About fifteen men in all had consumed the ice-cream, but none of the others developed the disease. This outbreak necessitated a block of the British Military Hospital being set aside for the exclusive treatment of cholera. A cholera segregation camp had also to be established at Jessfield, with separate cooks, cook-houses, latrines, etc.

Owing to the very bad sanitary condition of "B" sector and the surrounding Chinese slums in the first week or so, cases of diarrhœa and dysentery had been fairly numerous during August and September and for a time the hospital was working to capacity. The opening of the British Military Skin and Venereal Diseases Hospital had, however, relieved the congestion and the International Recreation Club building proved quite satisfactory as a general hospital. The total number of beds in a hospital is, however, but a poor index of its practical capacity which really depends on the facility it offers for the separation of different classes of case.

No. 1 Field Hygiene Section arrived from home on October 8. This unit would have been worth its weight of gold in the very early stages when the overworked R.E. and the units had to do a great deal of urgent sanitary constructional work. There still remained a great deal to do, however, and the unit proved of the very greatest value in the succeeding months. The offices and workshops were established at Mohawk Road barracks and the personnel were billeted at the Union Jack Club. The temporary Disinfestation Centre was moved here and placed under the control of the O.C. No. 1 Field Hygiene Section.

The Medical Services were now complete and their disposal was as follows:—

British Military Hospital	International Recreation Club.	
Officers and O.R.		
S.M.O.	1	
O.C.	1	
Q.M.	1	
M.O.	8	includes 3 R.M.O.
O.R.	70	
Total	81	
Q.A.I.M.N.S.		
Matron	1	
Sisters	11	
Total	12	

British Military Skin Hospital		Jessfield Camp.
O.C.		1
M.O.		2
O.R.		30
	Total	33
No. 1 Field Hygiene Section		Mohawk Road Camp.
O.C.		1
O.R.		22
	Total	23
	Grand total	149

THE JAPANESE ADVANCE—EVACUATION OF BRITISH MILITARY SKIN HOSPITAL.

In October there was a marked drop in the incidence of gastro-intestinal disease owing to the strenuous sanitary campaign instituted in August and September, and the pressure on the British Military Hospital relaxed considerably. The British Military Skin Hospital at Jessfield was, however, fairly full, and, moreover, the accommodation in the old wooden huts was not of the best. For those reasons it had been decided, during the A.D.M.S.'s visit in September, to move the British Military Hospital back to its old site at Central Road whenever circumstances permitted, and then to move the British Military Skin Hospital to the International Recreation Club. This would have provided excellent accommodation for both the hospitals and would have been moderately easy to carry out; but owing to the rapid advance of the Japanese matters were once again taken out of our hands.

The intensity of the fighting in the Chapei district and along "B" sector had increased daily, and the North Station, within a few yards of our posts, suffered a severe daily bombardment by Japanese bombs and artillery. It is to the credit of both the belligerents that little damage was done to our defences, which literally were "just across the road" from the battle. The photograph (fig. 3) will give an idea of the sharpness of the line of demarcation between the war and the neutral zones. Although casualties were daily expected in this area actually there were none which were directly due to the hostilities, although there were many narrow escapes.

From the commencement of the emergency and throughout September and October Chinese air raids were an almost nightly occurrence and there were many civilian casualties in the Settlement as a result of the Japanese anti-aircraft. Several fragments fell in the British Military Hospital compound without doing any damage; one shell penetrated the roof of the Country Club ballroom.

On October 23 the Japanese big push to dislodge the Chinese from Chapei and North Station began, and the areas along the Soochow Creek from "B" Sector to Jessfield were heavily bombed. The following day, Sunday, 24th, a Japanese plane flew, at low altitude, up and down Keswick Road which is inside the British defence Sector "D," and machine-gunned civilians on the road. The plane then dived and attacked the British "Q" Post and shot Rifleman McGowan of the Royal Ulster Rifles, who died almost immediately. This was the first British battle casualty. The

FIG. 3.—"B" Sector. Sharp line of demarcation between devastated area and British Posts.

incident aroused bitter resentment among the entire population of the Settlement.

The fighting now increased in intensity and bombing continued day and night for the next few days. On October 27 the Chinese, who had suffered severely, evacuated Chapei and withdrew westwards along the Soochow Creek towards the Jessfield district. It was now obvious that the fighting would follow the Creek to Jessfield and thence southwards along the Shanghai-Ningpoo Railway. As Jessfield camp was situated at the apex of the salient formed by the Creek and the railway it was

likely to become exceedingly unhealthy in the near future. In view of this orders were received to evacuate the British Military Skin Hospital at once.

As the hostilities had now receded from Chapei and the "B" Sector area it was decided to move the British Military Skin Hospital into the original British Military Hospital at Central Road and to effect the change over of the hospitals at a later date. The evacuation of the British Military Skin Hospital was completed by 6 p.m. that afternoon. It was well that the hospital was evacuated, for in the course of the next few days several shells landed in the camp and the hut that had been occupied by the R.A.M.C. personnel was hit. Moreover it was within a few yards of the evacuated hospital that the Royal Ulster Rifles suffered most of their casualties. The Chinese were also preparing to blow up the Jessfield Bridge no more than 100 yards distant.

Chapei in Flames—British Posts again Attacked.

Prior to evacuating Chapei the Chinese set fire to numerous buildings, and within a few hours the whole district was a raging inferno. I have never seen such an extensive conflagration, nor do I call to mind anything in the Great War which even approached it. That night the northern sky was one solid mass of flames almost two miles wide and reaching hundreds of feet in height. It was fortunate that the wind was in the right quarter or the fire might well have extended across the perimeter into the Settlement. Several houses did actually catch fire but these were promptly dealt with by the Fire Brigade.

During the day the British "D" Sector posts were again machine-gunned by Japanese planes and several bombs were dropped inside the perimeter near Great Western Road. There were, however, no Army casualties. In view of recent events it was thought that these posts might become isolated under heavy fire and arrangements were made to evacuate casualties in Shanghai Volunteer Corps armoured cars should the necessity arise. At no time, however, was this necessary.

Refugees from the surrounding villages continued to pour into the western district through the British defence lines. Chinese troops were now retreating across the Soochow Creek near Jessfield, and there was heavy bombing of this area. From the roof of our flat, which was only 400 yards from the perimeter, we had an excellent view of the battle. The next day there was a lull in the fighting: both sides were resting and consolidating their new positions.

British Casualties.

October 29 was an ill-fated day for the Royal Ulster Rifles. The Japanese artillery opened fire in the evening and several shells landed in Jessfield camp; one fell near a sandbag post and killed two Riflemen and wounded

two others. One of the latter died the next morning. Another shell exploded near the gates of Jessfield Park and killed another Rifleman in a café on Yu Yuen Road.

On October 31 three Riflemen were wounded in the same sector by a stray shell.

Of the nine casualties in the Ulster Rifles four were killed outright, one died later in hospital, and four recovered. The mortality was high, possibly due to the fact that most of the wounds were multiple and penetrated deeply owing to the smallness of the shell fragments. The modern H.E. shell appears to break up into much smaller pieces than used to be the case.

Recession of Hostilities from Shanghai.

During the first week of November the fighting proceeded southwards along the perimeter on the Shanghai-Ningpoo Railway, and westwards along the Soochow Creek. Soon the noise of battle to which we had become so accustomed in the preceding three months ceased, and the immediate emergency, so far as Shanghai was concerned, was over. The perimeter had still to be manned; the severe Shanghai winter was at hand; and the Settlement was overcrowded with refugees. The emergency so far as the Medical Services were concerned was by no means over. The various problems connected with this period are described later.

Return of British Military Hospital to Central Road—Reduction of Garrison.

Central Road, where the British Military Skin Hospital had taken temporary refuge, was now being prepared by the R.E. for the return of the British Military Hospital. Originally the British Military Hospital had occupied the upper five floors of this eight-storied building, but with the increase in beds an extra floor had to be taken over as well as half the ground floor which had to be converted into medical, linen and pack stores. Bath and ablution rooms had to be improvised on the new second floor and many alterations and repairs had to be completed. This work was completed on November 8, and the next day a ward-by-ward move of the British Military Hospital commenced and the British Military Skin Hospital was transferred to the International Recreation Club. By the 11th the change-over of the hospitals was complete.

In a period of three months each hospital had moved three times, and although no doubt excellent practice in arranging and adapting various buildings for use as hospitals, this constant shuffling did not render the routine medical administration any the easier.

With the recession of the hostilities from Shanghai the probability of battle casualties had disappeared and it was estimated that 156 to 200

beds would be sufficient. Accordingly, on January 17, the British Military Skin Hospital at the International Recreation Club was closed down as a separate entity, and absorbed into the British Military Hospital at Central Road.

On February 1 the garrison was reduced by one battalion and as the perimeter was now being held with far fewer men the necessity for a complete Field Hygiene Section no longer existed. Accordingly this unit also took its departure on this date, leaving only one Staff-Serjeant to act as sanitary inspector, and one Corporal and one Other Rank to run the Disinfestation Station.

The hospital staff was also reduced to :—

Officers	8
Q.A.I.M.N.S.	10
O.R.	70

The bed accommodation of the British Military Hospital at Central Road was now 156, expandible to 200.

Problems in Hygiene and Sanitation.

The Settlement was overcrowded with homeless refugees who squatted, in more than one sense, in and around the areas occupied by the troops. In many places the municipal sanitary services had ceased to function and these areas were foul and filthy. The fly season was at its height and it was almost inevitable that cholera, dysentery, etc., should take enormous toll of life amongst these ill-nourished people.

The propensity of the Chinaman for dumping his dead on the surface of the ground, anywhere and everywhere, did not help matters. Tens of thousands of corpses were dumped throughout the Settlement, and had to be collected and incinerated by the P.W.D. Hostilities and disease were responsible for numbers of corpses which floated up and down the Whangpoo River and the Soochow Creek with the tide. It is said that the waterworks had to detail a special "corpse pusher" to keep the intake from the Whangpoo free from bodies!

These then were the conditions against which we had to prepare our scheme of defence. Fortunately the Settlement has a modern and very efficient Public Health Department, which did wonderful work under the most difficult circumstances. It is also blessed with an excellent water supply: the water is sedimented, filtered, and finally chlorinated by Wallace-Tiernan apparatus, and the resultant standard is extremely high. Water-borne disease was therefore unlikely. The main waterworks, however, was situated in the Japanese area and there was a possibility that it might be damaged and thrown out of action in the course of the hostilities. Accordingly a survey of artesian wells, of which there are many, was made and the swimming bath at the British Forces Recreation Club was

held as a reserve military supply to tide over any breakdown which might occur.

Fly-borne Disease.

For the reasons stated above protection against the fly-borne diseases was by far the most urgent problem during the period July-October. At short notice the British troops had to occupy the most insanitary areas in "B" and "D" Sectors. The civil sanitary services had completely ceased to function in "B" Sector, which is situated in the overcrowded

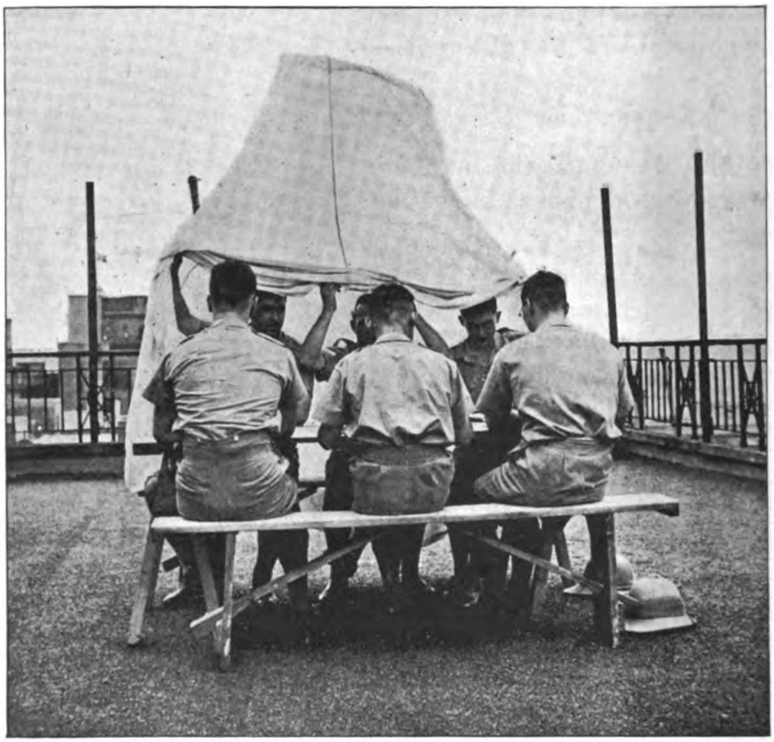


Fig. 4.—Prevention of fly contamination. Six men dining at barrack table under mosquito net.

slum areas north of the Soochow Creek. The narrow lanes of this rabbit-warren were littered with fæces, filth, and decaying organic matter, and flies were breeding in their millions. Under these appalling conditions our troops had to live and eat. The chances of avoiding a serious outbreak of gastro-intestinal disease appeared to be small.

A strenuous sanitary campaign was commenced immediately. Squads of Chinese coolies were engaged to clean up and remove the refuse daily. The lanes and alley-ways were washed down with fire hoses, and all the

usual anti-fly measures were instituted. These measures could only be applied in the immediate vicinity of the posts occupied by the troops and there still remained, near at hand, areas with which it was impossible to deal. It was obvious therefore that equal if not greater attention would have to be paid to the protection of food, because fly breeding could not be eliminated or even greatly reduced by anti-fly measures alone.

Permanent fly screening of block-houses and posts was impossible at this stage of the hostilities: most of the cook-houses were hastily con-

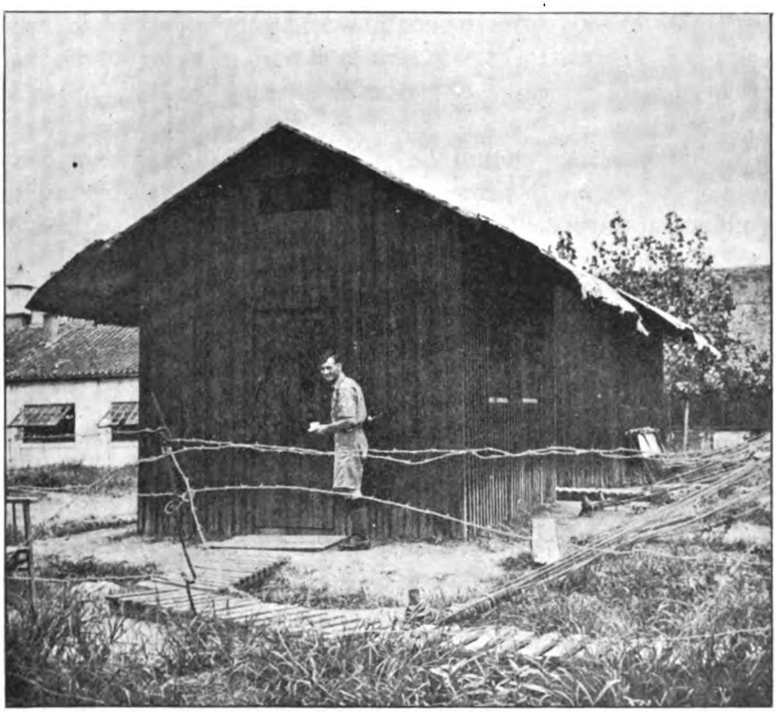


FIG. 5.—Prevention of fly contamination. Fly-proofed dining huts with self-closing doors. Hot boxes opened only inside. Utensils, etc., stored in meat safe inside the hut.

structed mat-sheds quite impossible to render fly-proof. In order to prevent fly contamination food was prepared and consumed under mosquito nets erected over barrack tables. The photograph (fig. 4) will indicate the method adopted. It will be seen that six men can easily feed at a six foot table protected by a net. This was merely a temporary expedient to tide over the initial period of emergency, but there is little doubt that it did in fact help to reduce the incidence of fly-borne disease.

Whenever circumstances permitted cooking was centralized in the permanent camps and no cooking was done in the sectors. Cooked meals in hot boxes were distributed by mechanical transport to the posts and

block-houses in the sectors. The effect of centralized cooking on the incidence of gastro-intestinal disease was very marked. The numbers admitted to hospital fell from 113 in September to 38 in October, although the civilian incidence remained substantially the same.

When the hostilities receded from Shanghai fly-proofed dining huts were provided for each hut in "D" Sector, and all the block-houses in "B" Sector were proofed (see photograph, fig. 5). Each had its own set of hot-boxes, which were only opened inside the post or block-house after it had been cleared of flies by spraying. This provided the ideal of complete protection of food from the cook-house to the mouth of the consumer. Plates, glasses, knives, forks, etc., were stored in a meat-safe inside the post. (There were no cases of fly-borne disease in 1937 up to the end of July.)

Too much emphasis cannot be laid on the importance of centralized cooking and the complete protection of food where the surrounding area is not under sanitary control. In Shanghai the very localized sanitary measures possible could have little effect on the fly population because the surrounding neighbourhood was so filthy.

The fly-sprays usually recommended did not prove to be very effective and were of little use as mosquitocides, and authority was obtained to purchase "K.C.P." fly-spray from the Shanghai Public Health Department. This spray, after much experiment, had been found to be very effective against both flies and mosquitoes. The formula is as follows:—

Pyrocide	25 oz.
Camphor oil (crude).. ..	1 pint
Kerosene (first quality) ..	10 gallons

The cost worked out at about 1s. 6d. per gallon, and we found it to be most effective.

The Cholera Outbreak.

Shanghai had been entirely free from cholera for four years, but on August 30 the first case was reported in the French Concession. The Concession was immediately put out of bounds, and inoculation of the entire garrison ordered. Orders supplementing the preventive measures detailed in Shanghai Area Standing Instructions were issued, and special emphasis was laid on the danger of consuming food and drink from unauthorized sources.

The epidemic soon spread to the Settlement and by September 11 fifty cases had been notified. On the 13th a case of cholera occurred amongst the British troops. On investigating the outbreak it was discovered that a number of men in a platoon of a certain battalion had bought and consumed ice-cream from a Chinese hawker in defiance of orders. The whole platoon was segregated and fortunately the five cases which followed all came from this platoon. All five had received one cubic

centimetre of cholera vaccine a fortnight before and therefore there was no question of the negative phase. One case died and one was very seriously ill and was eventually invalided home. The remaining cases were very mild and made uninterrupted recoveries.

The outbreak is illustrative of several points regarding inoculation: (1) Inoculation apparently does not protect against a massive dose. (2) Two of the cases might have been passed as severe diarrhœa had the stools not been examined for cholera. (3) About ten men who had eaten the ice-cream did not develop the disease, and their stools were all negative.

The epidemic continued until the middle of October when there was a sudden drop in the incidence; a few cases occurred each week until December when they ceased altogether. A total of over 3,500 had been notified in the Settlement alone; there were many more in the French and in Chinese territory, and probably many had not been notified.

Malaria.

Malaria has been increasing in Shanghai in the past few years. Old residents, some of them doctors, declare that malaria did not exist here until it was introduced by the troops during the 1927 trouble. Whether this is true or not, the fact remains that 1936 was the worst year Shanghai had experienced. Under normal conditions there were 64 military cases in the period July-October of that year with a garrison of only 950. In 1937, with three times the garrison, and with many men exposed day and night in the most malarious areas of the Settlement at the worst season of the year, it was feared that malaria might attain serious proportions.

"D" Sector was by far the most dangerous area. Here there were numerous ponds, pools, and creeks where anophelines were known to breed, and although arrangements were made to have them oiled regularly there were many more just outside the barbed-wire perimeter which could not be treated. It was also exceedingly difficult to make protection by means of nets, etc., effective as the men were living in rather cramped sand-bag posts. During fine weather men not actually on duty slept under nets, slung from a wire stretched between posts driven into the ground outside the block-houses. Bamber oil was issued to each post and as far as possible veils were used; but for the reasons stated above the protection was far from perfect. In view of this it was decided to make use of prophylactic quinine.

It is not easy to assess the effects of quinine on the incidence of malaria, for although there was a marked drop compared with the previous year there was a proportionate drop in the civilian incidence, and it is thought that the very dry summer was largely responsible. The comparative figures were :—

1936	..	..	65·71 per 1,000
1937	..	..	36·45 ,, ,,

WINTER ACCOMMODATION IN THE SECTORS.

With the approach of winter the problems in hygiene and sanitation underwent a change. The Shanghai winter brings perishingly cold winds, frost, rain and sometimes snow, and we had therefore to consider how the troops guarding the perimeter were to be housed. In "B" Sector the problem was comparatively simple as the concrete block-houses there could be heated by electric radiators, and were completely weather-proof.

In "D" Sector the problem was not so simple, as it is situated in open

FIG. 6.—Winter accommodation in the Sectors. E.P. tents with wooden walls and floors, and brick fireplaces. Walls removed in warmer weather.

country and the only existing shelters were the hastily constructed sandbag posts. These posts were by no means weatherproof and from the nature of their construction were cold and draughty. Overcrowding had to be considered as well as adequate protection and warmth. Huts of corrugated iron and wood to accommodate 10 men at 60 square feet of floor space for each post would have been exceedingly costly and hardly suitable for the "front line." A compromise was reached, after much debate, in the decision to utilize E.P. tents fitted with a wooden floor and walls, and a brick fireplace. The photograph gives a good idea of the arrangement (fig. 6). The chimney and fire provided good ventilation, and they proved warm and comfortable in the coldest and windiest weather. During the hotter weather the wooden walls were removed and the "flies" adjusted to take full advantage of the breeze. In this respect

they were more adaptable than wooden huts with fixed walls would have been.

Lice-borne Disease.

Typhus and relapsing fever are of common occurrence in Shanghai, and with the influx of refugees and their proximity to the military areas, there was a distinct risk of these diseases spreading to the troops. In this respect "B" Sector, situated in the slums of the Settlement, was by far the most dangerous.

As far as possible refugees were cleared from the immediate vicinity of the posts; it was not possible, however, to evict permanent residents and the danger of close contact could not be entirely eliminated. The following measures were therefore adopted. All men on relief from the sectors were medically examined, had a bath and change of underclothing, and their blankets and kit were sent to the disinfestation station. Block-houses and posts were regularly washed out with cresol on each relief. By these means infestation with the body louse was completely controlled. There were, however, a good many infestations with "crabs" derived from a different source, but fortunately of less medical significance.

It is rather ironical that the only military case of typhus was fatal, and occurred long after the emergency had ceased; that he had never been in the sectors and was entirely free from lice on admission to hospital. He had, in all probability, picked up a single infected louse in a ricsha.

The Disinfestation Station.

This was temporarily established at Jessfield and consisted of an ancient Thresh and a small battery of Lelean sacks. On the arrival of the Field Hygiene Section it was moved to Mohawk Road. An Aldershot box was now added and steam for this and the sacks was generated by the oil and water drip method with apparatus improvised by the Section. Waste oil from the sumps of motors was used and it proved very successful.

There are two practical points which should be mentioned. Many of the Lelean sacks had been in store for some time and were quite useless when unpacked. It is thought that the "dope" used in water-proofing them tends to harden and rot the canvas, and it is suggested that either a new "dope" be devised, or that the sacks be stored undoped. The "dope" could be stored in drums and only applied before use. Secondly, the Aldershot box was made of comparatively soft wood which could not stand up to continued use. These boxes should be made of hard seasoned wood and generously reinforced with steel corner pieces and fitted with very strong hinges.

At a later date a second Thresh arrived and the pair were well able to deal with all the work of the Garrison.

CONCLUSION.

The Shanghai Emergency has been an interesting and instructive experience for all of us, and more especially so for the very junior officers of the Corps who had never been on active service.

In spite of the occurrence of epidemics of cholera, dysentery, measles and typhus, and of cases of smallpox, cerebrospinal fever, diphtheria, etc., in considerable numbers in the Settlement, and the appalling state of overcrowding and filth the health of the troops was remarkably good. With the exception of the initial increase in the incidence of fly-borne disease and the five cases of cholera there was no notable increase over the normal numbers admitted to the hospital. In several instances there was an actual decrease.

The question of reinforcements of personnel and medical supplies has not been dealt with in detail because this article is merely intended to be an account of purely local events. To have done so, it is felt, would have rendered it too lengthy and rather difficult to follow.

I am indebted to Colonel J. T. Simson, A.D.M.S. China Command, for permission to submit this article for publication.

NOTE BY LATE A.D.M.S.

The General Officer Commanding, Shanghai, quickly realized that besides the actual trouble the real war was, as he expressed it to me, the one against disease. His whole-hearted co-operation and that of the battalion commanders and the constructional work done by the Royal Engineers, undoubtedly did an enormous amount to reduce disease.

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OBSERVATIONS AND CLINICAL NOTES ON SOME CASES OF PELLAGRA SEEN IN CYPRUS.

By Captain O. R. L. L. PLUNKETT,
Royal Army Medical Corps.

Three cases of pellagra have been seen in wives of serjeants serving in Cyprus. Since observing these and demonstrating them to doctors, various other cases have been remembered which might have been pellagra. A mild case was also seen shortly afterwards in a native; it was an obstinate eczema which cleared up rapidly on treatment with yeast.

It is thought that a description of the disease as seen in Cyprus may be of some value on account of its rare occurrence. Pellagra is now accepted as a disease due to deficiency of vitamin B_2, a complex substance of which lactoflavin is one known constituent and nicotinic acid probably another.

The relationship of the disease to protein intake has been much discussed; a quarter of a pound of fresh meat daily is said to prevent pellagra. Maize bread also was at one time thought to be a causative factor; this cereal is deficient in tryptophane. Since it has been shown that 15 grammes of yeast containing 7 grammes of protein are equivalent in curative value to 200 grammes of lean meat containing 45 grammes of protein, it is now believed that the protein content is not the essential factor.

Vitamin B_2 is said to occur in lean meat, milk, tinned salmon, eggs, green leaves, potatoes and yeast. Cereals are all poor in vitamin B_2, although it occurs in the wheat germ. The flavins are known to exist in animal tissues, milk, eggs and yeast. Vitamin B_2 is thermostable and is present in cooked foods.

The disease is common in women of 20 to 50, and intestinal parasitic diseases are thought to predispose to it.

The main symptoms of the disease are often summarized as the three "Ds": Diarrhœa, dermatitis and dementia. These may be present in greatly varying degree.

In the present series of cases dermatitis associated with marked depression was the predominant symptom.

The prodromal symptoms are depression, headache, vertigo with low blood-pressure. Digestive disturbances may be present for three months prior to the eruption. A painful red-edged tongue with stomatitis may be seen; diarrhœa, dyspepsia and anorexia with achlorhydria also occur. Macrocytic anæmia may follow later. Mental symptoms are progressive,

starting with depression and an irritable temper. Nervous lesions suggesting cord degeneration may occur; pains, weakness and increased tendon reflexes are the most frequent of these variable symptoms.

The dermatitis usually occurs earliest on the backs of the hands and is typically seen on the exposed surfaces; it is aggravated by sunlight. A rash on the genitalia and covered areas is also described. The rash is always symmetrical, and after some time the skin shows pigmentation; commonly there is a sharp edge to the involved areas.

Swelling of the skin, blebs, and a lupus-like redness of the face of butterfly shape are all common features.

Recurrences, particularly in the Spring, are common. In recovered cases a change from the proper diet often produces relapse.

The first case was not the first seen but was the most severe and will be described in detail.

Case 1.—Mrs. H. aged 32, wife of R.A.S.C. Supply Serjeant.

She had one child aged 4, and had been abroad and in Cyprus since April 13, 1937. She was first seen in April, 1938, and then had a scaly dermatitis of the backs of the hands which gradually extended a few inches up the forearms. The rash caused irritation at times.

The rash resembled the dermatitis seen after washing up with much soda or that observed in washerwomen. This patient gave up doing much cleaning but there was no improvement; most known ointments and lotions were tried in turn.

In May she went to a German specialist who considered the disease was due to a protein sensitivity and put her on a diet containing no meat, no eggs, and no milk (i.e. a pellagrous diet). She also had injections of calcium gluconate.

She continued on this diet from the middle of May to June 16, when the Garrison moved from the very sticky heat of the plains (97° F.) to the hills of Troodos at about 6,000 feet. Here the dermatitis faded and she began to eat whatever she liked.

In August I was asked to see her and prescribe a tonic as she had become depressed, listless and very irritable and was refusing to go out. On August 16, I saw her and the dermatitis had vanished except for a very slight dryness of the backs of the hands. She attributed her mental condition to worrying over her hands, but agreed that she had little to upset her as they had got better. I gave her Easton's syrup.

On August 18 the patient was seen in a great state of perturbation about a rash. This rash had started the day before. The rash was identical with one I had seen two days before in case 2.

It is interesting to note that the patient declared that she had not been out in the sun for two months as she hardly went out at all.

The distribution of the rash was as follows: Extensor or exposed

aspects of shoulders, arms, forearms and hands (not palms), the neck and chest down to the edge of the blouse and the anterior aspects of the legs as high as the skirt margin; here the fading was gradual, corresponding to various heights of the skirt. Elsewhere the margin was sharp at the clothing edge.

The rash consisted of very closely placed granular, red papules with a slightly shiny top resembling a piece of shagreen, or the skin of any rough scaled fish.

I had never seen this rash before, but it was a constant feature in all the four cases I have seen lately at an early stage.

It is best seen in fig. 1, just below the sleeve.

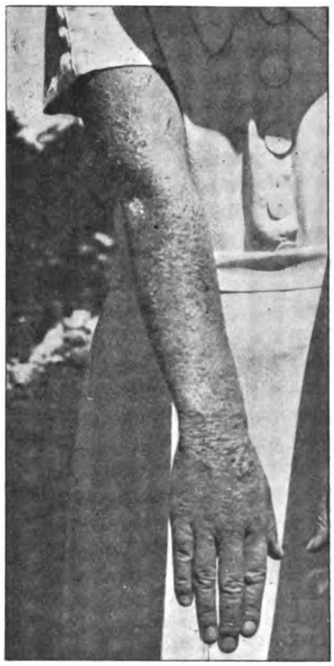

FIG. 1.—Early stage. Lichen planus-like rash, best seen below sleeve.

Each papule was bounded by the fine lines of the skin, and strongly suggested the plaques of lichen planus; their colour and distribution were, however, against this diagnosis.

It is possible that lichen planus may be an allied condition and the history of preceding mental strain is suggestive. Treatment by nicotinic acid would settle this point.

Under the shoe laces the skin surface was red, swollen and broken, and about the wrists and ankles were small blebs. The rash was present all over the face. In parts of the arm the skin was much thickened and

swollen and there was impetigo appearing at the wrists although the rash was only one day old. There was irritation.

The pulse was slow and very soft; no abnormality was made out in the central nervous system nor in the digestive system, except that the patient complained that her appetite was very bad.

The impetiginous areas were covered with unguentum hydrarg. nitratis dil., and the arms were loosely covered with lint.

FIG. 2.—Thickening and wrinkling with desquamation and impetigo.

FIG. 3.—Showing swelling and redness of face and narrowing of palpebral fissures by swelling.

Dried yeast, bemax, marmite, and fresh milk were ordered, together with a good mixed diet of meat, eggs, etc.

On August 20 the patient was seen again (fourth day). There was wholesale desquamation on the arms where the skin was now much thickened and creased; the impetiginous areas had almost disappeared. Irritation had ceased (fig. 2).

The skin was so fragile that it had broken at the elbows from the pressure of the lint.

The face was swollen and very red, and looked like a very severe sunburn. The swelling was not great in the lips, but the eyes were almost

closed (fig. 3). The granular rash had vanished from the face; there was a deeper red butterfly-like area across the nose and cheeks.

On August 22, the whole of the face and affected areas were covered with desquamating shreds. The change in mind was most surprising; from alarm and despondency the patient changed to complete confidence, and was amused at the "mess she was in," although probably she was looking worse than at any time.

FIG. 4.—Feet, showing pigmentation in affected areas, and sharp border at shoe edge. Not sunburn, but developing during the disease.

FIG. 5.—Final result. Compare face in fig. 3. Slight recent impetigo on neck. Notice that long sleeves are worn for protection.

In view of the skin destruction under even light-bandage pressure it became necessary to fit loose sleeves of lint at this stage.

Three days later she was seen again, desquamation was largely complete. There was impetigo at the wrists and some roughness of the desquamated areas. Removal of the shoe now showed clearly that the affected areas were pigmented (fig. 4).

On August 30, she had extensive areas of impetigo on both arms, owing to leaving off her lint sleeves. This was treated with ung. hydrarg. nit. dil. as before.

From this time on she wore grey flannel slacks and lint sleeves, a scarf and sun hat. Any omission of these was followed by patches of impetigo and redness.

Her appetite had been very bad, so hydrochloric acid was taken with meals; this was found to improve her enjoyment of food enormously; and had the same effect in all the cases. Unfortunately facilities for test meals were not available.

From the end of August there was continuous progress, the patient taking 40 grammes of dried yeast daily, hydrochloric acid and the diet already indicated.

By October 8, there was no sign of the skin lesions except for small red marks like scabies scattered about her shins. She had now returned to the plains (temperature 83° F.).

On October 20, following a spell of hot weather and probably exposure to the sun, her neck became red again with some impetigo (fig. 5). This has since cleared. She now states that she feels better in health than for many months.

There is no doubt that she looks fatter and younger and is very cheerful as compared with a certain moroseness when first seen. She is still taking a maintenance dosage of yeast which it is hoped to replace shortly by nicotinic acid.

Case 2.—Mrs. F., aged 26. Wife of serjeant, 1/R. Sussex Regiment. Has been abroad since September, 1937, in Cyprus since November, 1937. Child born December, 1936. Had a "white leg" on the left side. Child breast fed to October, 1937. She is a teetotaller. Her husband diets himself for gastric trouble, but she states that she takes a good mixed diet except that, from May, 1938, she gave up her breakfast of eggs and bacon.

In May, 1938, she had a mosquito bite above the left ankle, i.e. the same side as the white leg. This bite never healed up completely. On August 1 the bite became worse and on August 14 the patient was seen for the first time.

She was an attractive-looking, well-nourished and cheerful young woman. There was an ulcerated bite above the left external malleolus and for a space of about three to four inches around there was an area resembling erysipelas. There were also a few pustular blebs in this region and some roughness of the surrounding skin.

The affected area was dressed with ichthammol and lint. On August 16 the patient was seen again; her face was brilliant red and swollen but not œdematous as in urticaria; the lips and eyelids were affected no more than the rest of the face.

There was a burning, irritating rash of exactly the same nature as that described in Case 1. The distribution was different and corresponded to the area not covered by her bathing dress. This is of great interest as she had not been wearing her bathing dress since May. It would appear that exposure to the sun predisposes to pellagra and dermatitis; and the sun then aggravates the rash on the exposed area.

The knee-jerks were brisk, there was no ankle clonus, the pulse was soft. The tongue was red at the edge.

The treatment was the same as in Case 1, except that an injection of adrenalin, followed by oral ephedrine, was given in the hope of allaying the irritation.

The patient stated that since her leg had flared up she had lost all appetite and had one meal a day.

On August 18 the red face was fading and the granular rash was less irritating, but clearly seen. She complained of headache which she had never suffered from except during the last week.

On August 22 the original bite had healed completely and there was fine desquamation all over the affected surfaces, the skin now being thickened and rough. By August 25 there was nothing to be seen except a few red marks resembling scabies, some roughness of the skin and fine desquamation. She continued the treatment and remained in perfect health without a mark on her skin until the end of September when her leg became affected at the site of the bite, with many surrounding blisters.

By October 5 the leg was worse and there was a slight erythema on the ante-cubital areas and the front of the neck, suggesting scarlet fever.

The next day the face was greatly swollen, the granular rash had appeared, and the patient was in a great state of depression; she confessed that she had left off the yeast which was most nauseating to her, after gradually cutting down the dose without any apparent ill-effect. She had also given up breakfast. Also the weather had been very hot. On October 7 after rest in bed, with plenty of yeast, marmite, and eggs in milk for the two days, the face was a little less swollen.

From this date she made a steady improvement, and by the first week in November was fully recovered, except for a few septic patches on the legs which were healing fast.

Case 3.—Mrs. S., wife of Serjeant 1/R. Sussex Regt., aged 39. Has much service in India, without ill-health.

At the end of July she had a circular red area about the size of five shillings on the left side of the forehead and two on the forearms. These were taken to be bites, but did not improve in spite of various applications.

August 16: She had a giddy attack and fainted; her husband remarked that she had been a bit off colour lately, and he thought it might be menopausal, but she was rather too young.

August 30: The red area had spread all over the right half of the forehead. This might be due to previous unilateral sun exposure in a car.

Small papules exactly as described in Cases 1 and 2 had appeared on the exposed surfaces of the forearms, particularly at the elbows. In this case the spread was not even but in patches about 1 by 1½ inch, fairly symmetrical on both arms and on the shins.

A week after treatment was begun the red areas had faded, although previously of one month's standing, and the rash had gone. Since then this patient only sends for hydrochloric acid and yeast and does not attend but states that she feels "better than she has done for years."

I am not certain about the diagnosis in this case, but the type of rash was similar to the other cases, and the red areas faded under suitable treatment. The prodromal history is also suggestive. She stated that she had marmite on bread about three times a week, which may have some bearing on the transient nature of the disease.

Two further cases occurred which closely agree with the accepted descriptions of pellagra *sine* pellagra; these were both ill enough to cause concern but recovered on return to the plains. Exact details as to dates were not recorded as the true significance of the syndrome was overlooked at the time.

Both were very active women and receiving a generous diet so far as was possible in Troodos.

They had the diarrhœa, sore tongue and emaciation of the gastric group of pellagra symptoms, together with depression and irritability.

Case 4.—Mrs. H., aged 34, wife of Serjeant, R.A.M.C. A very healthy, active woman. Became increasingly irritable and complained that the place was not suiting her. She had repeated attacks of diarrhœa, which I attributed to food poisoning, although no other member of the family seemed involved. The symptoms did not suggest hill diarrhœa.

Later her tongue was sore with large red papillæ, her appetite vanished, and her usual happy frame of mind changed considerably; diarrhœa became more frequent and in the last week she lost 4 lb.; her total loss in weight in three months being almost a stone. The central nervous system was not examined. She was treated with a strychnine tonic without benefit. On return to the plains she was better in a few days.

Case 5.—Mrs. P., aged 23, wife of a Captain, R.A.M.C. A very active and cheerful type. Never ill. Was lactating during the first half of her stay in Troodos but this was discontinued owing to loss of weight. She was on a liberal diet.

She became progressively worse after the first month in the hills. She complained of a sore mouth, diarrhœa, loss of energy and lost half a stone in six weeks. Cessation of lactation made no difference to her weight. The diarrhœa was accompanied by much mucus, about four ounces at a time; there was no morning incidence as in hill diarrhœa. Repeated examinations showed a few extra cells; no abnormal organisms were found. On one occasion diarrhœa persisted for eleven days in spite of

treatment. Blood examinations for anæmia were not made as at these altitudes red blood examinations are most misleading.

It now remains to discuss the causative factors in these cases.

In the Garrison there were the wives of two officers, the wife of a warrant officer and the wives of six serjeants. Of these nine women, one officer's wife, the warrant officer's wife (a woman in late pregnancy), and one other, escaped ill-health. The last-mentioned was the only one of the six serjeants' wives who employed a servant; she went out very little.

It will be seen that of nine wives, five were ill; of the other four, one was pregnant and doing very little, and the other three employed servants and so were saved physical exertion. The officer's wife who became ill is abnormally active and was losing vitamins by lactation.

Examination of the diets revealed the following abnormalities: Fresh milk in the hills is double the normal price and all except Case 5 used dried milk. There is only one butcher, who has a monopoly, and was supplying inferior ration meat three days a week until this was stopped and a good frozen supply obtained. This had been so for many years. Oranges and cabbages were unobtainable, there is little irrigated land in Cyprus and during the summer green vegetables are almost unobtainable, beans are hard and unpalatable and tomatoes green or rotten.

Importation of fruit and vegetables is illegal. The only unusual feature differing from other years was that for about six weeks nearly 50 per cent of the eggs supplied in the shops were bad. These had been stored for sale during the annual visit of the Fleet which was postponed. The result was that a person hoping to eat two eggs would find one bad, and probably do without rather than wait for another, thereby halving the daily egg intake. The cost of all food in Troodos is raised by 30 to 50 per cent partly to cover transport and also because it is mainly an English holiday resort. These prices are increasing annually, so I am informed, this may also be a factor. Variety of food is deficient and much tinned stuff is consumed.

The effect of altitude must now be considered. Morland (1936) [3] reviewing sanatoria for phthisis states that at 5,000 feet basal metabolism is stimulated by the low barometric pressure and is increased by 20 per cent. Samson Wright (1937) [4], however, states that though oxygen lack at altitudes stimulates breathing there is no change in metabolic rate.

Continued fall in external temperature definitely raises the basal metabolic rate.

There are no cinemas and the only recreations are walking and riding. Owing to the steep nature of the ground walking is very arduous. The sense of well-being on changing from the heat of the plains causes most people to take unaccustomed amounts of exercise.

Wilson has shown in the Report of the Commission on Pellagra among Turkish Prisoners in Egypt that men on a low diet developed pellagra if

they were put to work, unless the diet was increased. He gave the gross protein figures necessary for workers as 120 grammes a day, i.e. about a quarter of a pound, and if they received 80 grammes pellagra might occur in men made to work. This amount may well be raised 20 per cent for altitude, and perhaps more for unaccustomed exertion.

It will be noted that both the two cases showing gross dermatitis had a history of deficient foods; one of eggs, milk and meat, the other of eggs at breakfast.

At Troodos eggs were bad, meat was poor, but was probably just sufficient in quality. Milk was an exorbitant price and green vegetables a rarity. Basal metabolism was raised by coolness and possibly by altitude, and there was much athletic recreation so that there was an increase in the need of vitamin B_2.

The combination of these factors produced definite pellagra in those having defective diets, a suggestive dermatitis and giddiness in another, and possible pellagra *sine* pellagra in two others.

The women who escaped the disease took least exercise and employed servants, thereby diminishing their food requirements.

Summary.

The present views on pellagra are mentioned briefly. Two cases of pellagra, and a probable third mild case, are described: All responded to treatment with dried yeast and diet before advanced symptoms could develop.

Two other cases are mentioned as likely examples of "pellagra *sine* pellagra," the supposed rarity of this condition being acknowledged. The causes are discussed and deficiency of vitamin B_2-containing foods together with increased requirements due to exercise and altitude are considered.

The transient resemblance of the rash in early stages to that of lichen planus is pointed out and it is suggested that this may be a form of pellagra in less sunny countries. Nicotinic acid will test this point.

The features of the rash and its appearance only on areas which had been exposed to the sun months before there was any suggestion of disease, are, I believe, described for the first time.

The existence of an ulcerating area for four months, healing with yeast and reappearing just before a relapse, suggests a good field for the use of nicotinic acid in indolent ulcers abroad, which may well represent a pre-pellagrous state.

It is believed that these cases and two others, Dill (1938) [5], are the first recorded cases in Cyprus.

I am indebted to Colonel J. C. L. Hingston, D.D.M.S., British Troops

in Egypt, for permission to send these notes for publication; also my thanks are due to Lieutenant-Colonel J. Sproule, O.B.E., R.A.M.C., Assistant Director of Hygiene, British Troops in Egypt, for advice, to Lieutenant-Colonel J. Duguid, Army Dental Corps, for photographs, and to Serjeant Freeth, R.A.M.C., for extensive and painstaking clerical help.

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Editorial.

REPORT OF THE MEDICAL RESEARCH COUNCIL FOR THE YEAR 1937-38.

THE Twenty-fourth Annual Report issued on March 1, covers the whole field of medical research and attempts successfully to correlate the work of investigators, so that all subjects treated may be related to the life and work of the nation.

In the twenty-five years since the establishment of the Medical Research Committee, which became the Medical Research Council in 1920, there has been a great increase in medical investigation in Great Britain and also in other countries, especially the United States of America. This activity has brought a great increase in knowledge of the body in health and disease which has had two influences on medical practice. In the first place it has resulted in a great improvement in methods of diagnosis and treatment of disease, which have become more and more costly, both in labour and in time, so that the burdens imposed on hospitals have become exceedingly heavy. This process might conceivably operate to the detriment of patients who could not be treated for lack of resources were it not accompanied by another process of a different kind—namely, a reduction in the incidence of disease by some discovery. A case in point is the treatment of many acute infections by sulphanilamide and allied substances.

The more rapid and effective cure of gonorrhœa by these drugs ought to result in a definite reduction in its incidence, not only because of their curative action but because they may reduce the spread of infection.

There is also the hope that these drugs may lead to a reduction of middle-ear disease, which often follows measles and scarlet fever or may be a sequel to a sore throat due to a streptococcal infection. There are said to be 2,500,000 people in this country with disabling degrees of deafness and that disease of the middle ear is responsible for a large proportion of these cases. It has been estimated that this condition is responsible for 90 per cent of acquired incomplete deafness in children.

There is often great delay in the application of knowledge to the prevention and elimination of disease. But means of curative treatment on the other hand are generally applied at once by medical practitioners and the latent period between discoveries and their application is often short. Prophylaxis against disease does not depend solely on the alertness of medical men or of Government departments; enlightenment of the public is just as important and a better method of informing and educating the public becomes imperative.

A striking instance of the delay in the application of new knowledge is the lack of public recognition in Great Britain at the present time of prophylactic inoculation against diphtheria. In 1937 there were 61,339 cases of diphtheria in England and Wales causing 2,963 deaths nearly all in children between the ages of 1 and 15 years. The Council regard this as pure tragedy in view of the needlessness of such deaths, for since 1929 inoculation against diphtheria has proved increasingly popular wherever it has been used. In parts of the United States and Canada, notably in Ontario, diphtheria as a clinical entity has practically disappeared as the result of preventive inoculation with diphtheria toxoid.

In an Editorial on the State of the Public we summarized the most important facts on this subject given in the Ministry of Health Report written by Sir Arthur MacNalty.

Another type of preventive measure against disease which has been delayed for years is to be found in improved nutrition. Better feeding has caused a great reduction in rickets throughout the country. It is interesting to recall that an attack on the problem of rickets was included in the first research programme of the original Medical Research Committee in 1914, and it is owing to the results of this work that the disease has been prevented.

The Report declares: A much greater consumption of milk and other dairy products, of eggs, of vegetables, including potatoes, of fruit, of fat fish at the expense of bread, biscuits, sugar and sweets, especially in early life, is an urgent national requirement: it will not only improve the physique of the people, but will reduce the amount of dental decay and greatly raise the standard of health. An increase in breast-feeding will still further reduce the mortality rate of infants from gastric intestinal troubles and bronchopneumonia; whatever advances in medical knowledge may come, until these simple precepts are adopted there will still remain a great deal of preventable disease in this country.

Nutritional problems in the Colonies are also being studied by new methods and this study is going to be intensified. The Report emphasizes the close connexion between food and exercise, and points out that if food of correct quality is being received the need for exercise will immediately show itself; improper feeding removes the inclination and even the ability to take exercise.

In last year's Report, a review of the general hormone situation was given and mention is now made of interesting discoveries which have resulted from the work in which the Council have been interested.

Synthetic œstrogen—di-ethyl-stilbœstrol—has been prepared by Professor E. C. Dodds, Dr. Lawson and Professor Robert Robinson, and represents an important advance in hormone chemistry. It has a structural

resemblance to the natural female hormone, œstradiol, but is much more active, even when taken in small quantities by the mouth, and can be easily made on a manufacturing scale. The Therapeutic Trials Committee of the Council have arranged for extensive trials of its clinical value.

Dr. A. S. Parkes and Professor Dodds have demonstrated that this synthetic substance, di-ethyl-stilbœstrol, taken by the mouth inhibits the changes in the uterus which precede gestation and thereby prevents the implantation of the fertilized ovum in the uterine mucous membrane. In rabbits it was found that oral administration could bring about interruption of pregnancy when once established. In inhibiting progestational changes œstrogens are capable, if given in excessive doses, of causing tremendous œdema and hyperæmia of the endometrium of the uterus. The remote effects on the activities of the anterior pituitary lobe with its controlling action on the normal functions of the sexual organs are still the subject of investigation.

Hormone therapy by repeated subcutaneous injections hitherto necessary can now be replaced by cutaneous implantation of tablets. Dr. Deanesly and Dr. Parkes, working at the National Institute for Medical Research, have found experimentally in animals that a simple and effective method of producing prolonged action of sex hormones is to insert them under the skin in the form of crystals or compressed tablets. The amount of hormone used after any time can be determined by removing the tablet and weighing it. The first clinical use of the method was made by Dr. Bishop of Guy's Hospital who found that a small tablet of œstrone relieved menopausal symptoms over a period of some weeks. Further clinical trials are being made in human beings.

During the past two years another observation of great interest has been made by Dr. F. G. Young at the National Institute which has allowed the disease diabetes to be studied experimentally from a new angle. In the course of an attempt to induce immunity in dogs to the so-called diabetogenic action of extracts of the anterior pituitary gland he has succeeded in producing the condition of diabetes which continues permanently without further injections. At first there was tolerance of the extract but by increasing the dose the tolerance disappeared and large quantities of sugar were passed in the urine, even when no further anterior pituitary injections were given. Dr. Young and Dr. K. C. Richardson have found by histological examination of the pancreas of these diabetic dogs that the islets of Langerhans show slight abnormality up to complete loss of the cellular structure. Professor Best and his co-workers in Toronto have found that insulin cannot be obtained from the pancreas of dogs rendered permanently diabetic by the anterior pituitary factor.

One of the difficulties in understanding the cause of diabetes in man

has been that the pancreas generally appears normal when such a case is examined microscopically after death. It is not known whether diabetes is due to too little insulin being liberated from the islet tissue or to interference with its activity when formed. Only further work can decide whether the anterior pituitary function acts primarily by raising the threshold of sensitivity of the tissues against insulin, or by direct effect on the islet cells, or by both mechanisms. The Council state it is clear, however, that the study of the human disease, diabetes mellitus, is now open to a new line of attack as the result of this work.

A revised third edition of the book "Alcohol: its Action on the Human Organism," has recently been issued. This monograph was originally prepared by an Advisory Committee appointed in 1916 by the Central Control Board (Liquor Traffic). On the dissolution of the Board in 1921 the Medical Research Council were invited by the Home Secretary to reappoint the Advisory Committee as one of their own investigating committees. The Council were glad to accept the invitation and completed the preparation of the second edition in 1924, which included the results of various new investigations. With the passage of years and a steady demand for the book a further revision became necessary, and the third edition has been prepared by the surviving members of the former Committee. The widespread misapprehensions as to the effects of alcohol justified the re-issue of the book which gives not only the results of the investigations made by the original Committee, but also an impartial account of experimental data and clinical observations published by different observers. Two of the commoner fallacies discussed in this book are that alcohol is a stimulant and that it has a warming effect on the blood and tissues when taken after exposure to cold. The first opinion is the exact opposite of the truth. The action of alcohol is primarily on the nervous system, and it is mainly, if not wholly, narcotic or sedative. The apparent stimulation is a direct effect of this narcotic influence—in that this may dull the drinker's perception of unpleasant conditions in himself and his surroundings and make him feel better and more efficient than he really is. Increased loquacity and freer gesticulation result from the removal of the control exercised by the higher nervous centres. The removal of this control and the decrease of critical self-consciousness are the most constant and characteristic effects of alcohol.

There is no justification for the popular view that alcohol is a direct stimulant of the heart.

Such value as it may have depends on its being a readily absorbable food and on its influence to weaken the excessive check on the heart's action exercised by the nervous centres, as well as by its sedative influence on the higher levels of the brain. The sense of comfort and well-being

may be of value in some forms of heart disease, but this is the reverse of stimulant action. When brandy is given to promote recovery from a simple fainting it probably acts by virtue of its irritant effect upon the mucous membrane of the mouth and nose; the fact that its effect appears immediately, long before any significant amount of alcohol could be absorbed and carried to the heart indicates the local and indirect nature of the action.

The alleged action of alcohol in warming up the body after exposure to cold is equally misconceived as a physiological process. Alcohol when first taken gives a sensation of warmth by flushing the skin surface, which may lead actually to loss of heat.

From the point of view of maintaining the deep temperature the influence of alcohol is bad. When taken in excess it is known to diminish the body's resistance to bacterial infections.

The researches of Wechsler, Minot, Strauss and Cobb and others have shown that the form of peripheral neuritis which appears in chronic alcoholics is due not to the poisonous action of alcohol on nerve tissues as was formerly supposed, but rather to a deficiency of B vitamins, and especially of B_1, in the alcoholic's diet. "Alcoholic neuritis" is to be regarded as a nutritional disorder closely related to beri-beri. Morbid effects of chronic alcoholism such as gastric changes and the "alcoholic heart" may be due, at least in part, to vitamin B_1 deficiency. The process by which alcoholism may lead to vitamin B_1 deficiency is still obscure, but among the factors responsible are decreased intake due to the poor appetite of the alcoholic and to the fact that he can obtain his working energy from alcohol instead of other foods. From the point of view of treatment this new work has been valuable, for it has been shown that alcoholic neuritis—formerly regarded as an intractable disease—will in some cases respond quite quickly to adequate doses of vitamin; though clinicians in England have not been able to obtain the dramatic cures reported by some workers in America.

At the National Institute for Medical Research, further investigations on the virus of influenza have been made by Dr. Andrews and Dr. Wilson Smith. The results of their work show that specific strains of the virus fall into four main antigenic types. There are other strains which do not show such a sharp type-specificity, but appear to react with the immune sera evoked by all strains of the human influenza virus. In addition to the type-specific and "master strains," there are yet others of intermediate type, neither so specific as the former nor so polyvalent as the latter, just mentioned, in their antigenic reactions. The American strains supplied by Dr. Francis and Dr. Magill fall into this intermediate group.

For the preparation of an effective vaccine a number of experimental

comparisons have been made of the immunizing potencies for mice and ferrets of vaccines prepared from specific polyvalent and intermediate strains of the virus and also of vaccines from any strain made by killing or inactivating it by different methods. The next step will be the trial on a human community of the protective effect of a vaccine prepared by methods which seem most likely to be effective in conferring immunity to any strains of virus which may be encountered, including such as are not specifically represented in the vaccine.

It has long been known that certain visible micro-organisms, such as pneumococci, are rapidly killed and dissolved by solutions of bile salts, of which sodium deoxycholate is particularly active, whereas other organisms are resistant to such treatment. The viruses of influenza, louping ill and chicken sarcoma (Rous) are inactivated by the deoxycholate with almost instantaneous rapidity, whereas those of vaccinia, ectromelia and foot-and-mouth disease are unaffected. In the case of the affected viruses the evidence for the action is the disappearance of infectivity, but there is reason to suppose that it depends on a lytic action analogous to that visible in the action on pneumococci.

Sir Edward Mellanby has published an account of his work on the experimental production of deafness in young dogs by diets deficient in vitamin A and rich in cereals. In a few months the cochlear division of the auditory nerve may be destroyed. The vestibule is also affected producing inco-ordination of movement. Serous labyrinthitis develops in the labyrinthine capsule resulting in complete destruction of the organ of Corti. All these effects can be prevented by adding vitamin A or carotene to the diet.

Associated with the conditions described and probably responsible for them is the overgrowth of the periosteal bone of the labyrinth. This growth produces degenerative changes in the auditory and other cranial nerves by causing stretching and squeezing of the nerve elements.

These experiments showing that vitamin A and carotene control the growth of bone in young animals, especially of the cranium, are considered to open up a new chapter of physiology.

Clinical and other Notes.

PNEUMOCOCCAL MENINGITIS—RECOVERY FOLLOWING TREATMENT WITH PRONTOSIL SOLUBLE.

By Captain J. McN. Lockie,
Royal Army Medical Corps.

There is already a considerable amount of literature available on the subject of the benzene sulphonamide group of drugs, but the following account may prove of interest, taking into consideration the very high mortality of pneumococcal meningitis prior to the introduction of the sulphonamides.

I was called out on the evening of July 18 last to see a native child, aged 8, living in very poor conditions in the local "bazaar." The uncle of the child gave me a history of one day's illness with neck rigidity, severe headaches and irritability. On examination of the child these statements were confirmed, Kernig's sign was found to be positive, the temperature being 104·8° F., pulse 120, and respirations 26.

Lumbar puncture was performed under conditions as sterile as the circumstances permitted. The cerebrospinal fluid was under considerable pressure and had a hazy appearance. Ten cubic centimetres of anti-meningococcal serum were injected intrathecally as a precautionary measure, and a blood slide was taken.

Examination of the cerebrospinal fluid showed numerous polymorphonuclear leucocytes and lymphocytes. The cell count was 250. No organism could be seen with the use of any of the ordinary stains—Gram's, Leishman's, Ziehl-Neelsen's—even after centrifuging. The blood slide showed polymorphonuclear leucocytes 85 per cent, lymphocytes 13 per cent, eosinophils and mast cells 2 per cent. The total white count was 18,000.

The child was seen again at 1 p.m. on the 19th. Temperature was 103·4° F., pulse 136, and respirations 24. The headaches were still very severe and the child could only be roused with difficulty.

Lumbar puncture was again performed, and the cerebrospinal fluid was found to be still under considerable pressure and hazy; 2 cubic centimetres of prontosil soluble were injected intrathecally and 3 cubic centimetres intramuscularly.

Examination of the cerebrospinal fluid was repeated and showed again numerous polymorphonuclear leucocytes and lymphocytes. The cell count

was 280. Several slides were stained with Gram's or Leishman's stain and all showed distinctive lanceolate diplococci. No streptococci, meningococci or tubercle bacilli could be seen, and the case was diagnosed pneumococcal meningitis.

The above procedure—2 cubic centimetres of prontosil soluble intrathecally following lumbar puncture and 3 cubic centimetres intramuscularly —was repeated daily until the tenth day. During this time the child showed gradual improvement. No cyanosis, nausea, etc., or other toxic symptoms were noticed. By the tenth day the neck rigidity had disappeared, the headaches were no longer troublesome and the child was sufficiently well to resent the lumbar puncture. On the morning of the tenth day the temperature was normal and the evening temperature 100° F.; pulse 96 and respirations 21.

The cerebrospinal fluid (which retained the red colour of the prontosil soluble only slightly from day to day) became less hazy and by the tenth day was clear. Polymorphonuclear leucocytes and lymphocytes were scanty—cell count 5. No organisms were seen in films stained with Gram's or Leishman's stain.

The blood slide showed polymorphonuclear leucocytes 73 per cent, lymphocytes 23 per cent, eosinophils 3 per cent and mast cells 1 per cent. The total white count was 10,000.

The prontosil soluble was stopped after the tenth day, when a total dosage of 50 cubic centimetres of the 5 per cent solution had been given.

On the eleventh day—July 29—I received a note from the uncle of the child stating that as she was now out of danger, they had decided to hand the case over to a local "hakim." Six weeks later the child had almost completely recovered.

According to the medical literature available, there are very few recorded cases of recovery in pneumococcal meningitis. Dr. Freida Young, of Wolverhampton, recorded a case in the *British Medical Journal* of August 6, 1938.

I was unable to trace any contact with any case of pneumonia, nor had the child any previous history of nose, ear, or chest trouble.

I should like to express my thanks to Colonel J. E. Ellcome, V.H.S., A.D.M.S., Lahore District, and to Lieutenant-Colonel J. B. A. Wigmore, D.A.D.P., Lahore District, for the interest and help that they have given me in this case.

A CASE OF HEMI-ANHIDROSIS.

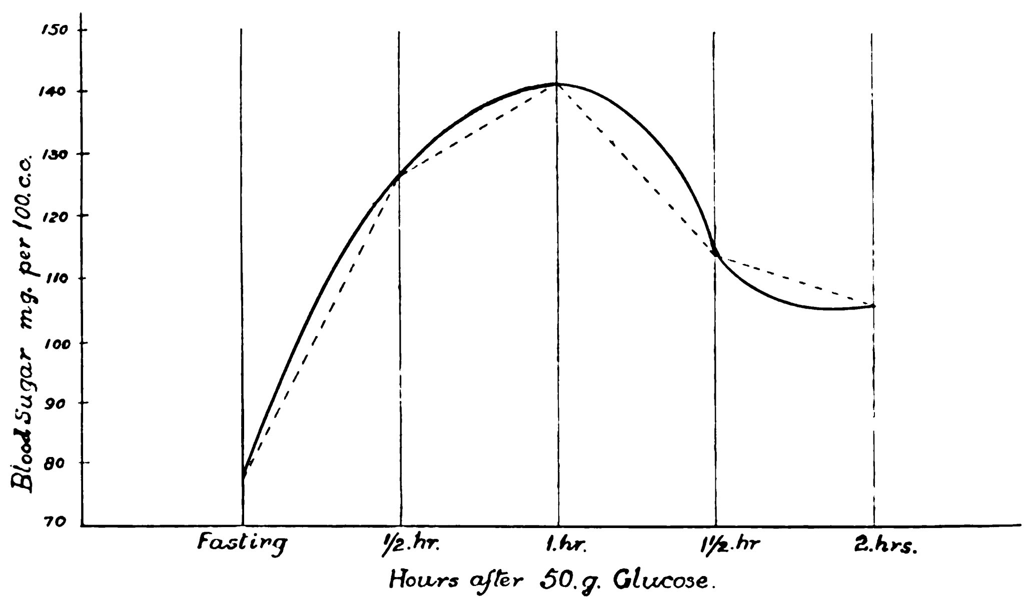
By Major D. N. CHAKRAVARTI,
Indian Medical Service,

AND

N. TYAGI, I.M.D.
(*From the Brigade Laboratory, Allahabad.*)

E. R. S., aged 46, an Anglo-Indian engine driver, reported on June 4, 1938, complaining of absence of perspiration on the left side of his body.

Past History.—The patient stated that he had an attack of heat stroke in 1933, at Moghul Sarai, after twelve hours' duty as the engine driver of a train. He was removed from the engine at 3 p.m. in an unconscious state and remained so till midnight. During the attack the maximum temperature under his right armpit was said to be 103° F., and that under the left 106° F. Irregular temperature persisted for about fifteen days.



He further stated that for some time after his recovery from the attack he felt considerable weakness in his left limbs and that he could not walk without support. The weakness in his limbs gradually improved, but ever since the attack he has been suffering from the absence of perspiration on the left half of the body.

He was recommended to drink salt water while on duty, which he did rather irregularly. Since 1933 he has had attacks of varying severity,

increasing year by year. His last severe attack was on April 23, 1938, which was precipitated by fourteen hours' duty as an engine driver.

Present Condition.—The patient is a heavily built man 5 feet $10\frac{1}{2}$ inches in height. On the day when he reported the left side of the body, particularly from the head to the waist, was found to be devoid of any visible perspiration, while the other side was perspiring freely. No abnormality in his reflexes or cutaneous sensations was found. The left side of his body definitely felt warmer than the right.

Biochemical examination of the blood gave the following results per 100 cubic centimetres: Plasma chlorides as NaCl, 660 milligrammes; lactic acid, 32·4 milligrammes; N.P.N., 44·44 milligrammes; inorganic phosphates, 2·85 milligrammes; creatinine, 2·21 milligrammes; urea, 68·14 milligrammes; uric acid, 2·59 milligrammes; amino-acid nitrogen, 13·48 milligrammes; blood-sugar (under normal diet), 124·96 milligrammes.

On June 12, a glucose tolerance test was carried out after he had been fasting overnight. The graph on page 336 shows the response. It would appear that the patient started with a low fasting level. The blood-sugar crossed his kidney leak point limit one hour after the administration of 50 grammes of glucose, and a trace of sugar was detected in the urine. Even two hours after the test dose his blood-sugar did not return to his fasting level.

Conclusion.

The biochemical condition of the blood gives an indication of damaged kidneys, which may be due to the repeated attacks that the patient suffered.

His usual blood-sugar level is higher than the average normal. The glucose leak point is lower than the normal and the tolerance test suggests a "lag curve." It may be noted that similar lag curves were found in most of our series of "Effects of Heat Cases." Further work alone will show whether such attacks result either in a permanently insufficient secretion of insulin, and thus predispose to a diabetic condition, or to an alteration in insulin-adrenal balance due to over-secretion of adrenalin.

We know that the secretory nerves of the sweat glands are derived from the sympathetic, controlled by centres in the cord, and the higher control is exercised by the hypothalamic region. It is probable that in the case under review the lesion is either in the higher centre or in the descending fibres from the subthalamic nucleus of the opposite side. It is also probable that the lesion originally involved motor fibres as well, which later recovered leaving a permanent damage to the secretory centres of the affected side.

A CASE OF INTERMITTENT FEVER WITH SEPTIC FOCUS IN THE MOUTH.

By Captain P. J. PIGOTT,

The Army Dental Corps,
Officer i/c Dental Centre, Razmak, Waziristan.

An Indian other rank, aged 28, was admitted to the Combined Indian Military Hospital, Razmak, on March 20, 1938, complaining of fever and rigors of four days' duration. The fever persisted, the temperature being normal in the mornings but rising each evening, the evening temperatures ranging from 99·4° to 102·4° F. (*see* fig. 1).

The patient had a past history of malaria, but clinical and laboratory findings did not support a diagnosis of malaria in the present instance. Repeated clinical and laboratory tests for enteric fever, dysentery, malaria, urinary infection and tuberculosis all proved negative, and X-ray plates of lungs, diaphragm and dorso-lumbar vertebræ showed no abnormality.

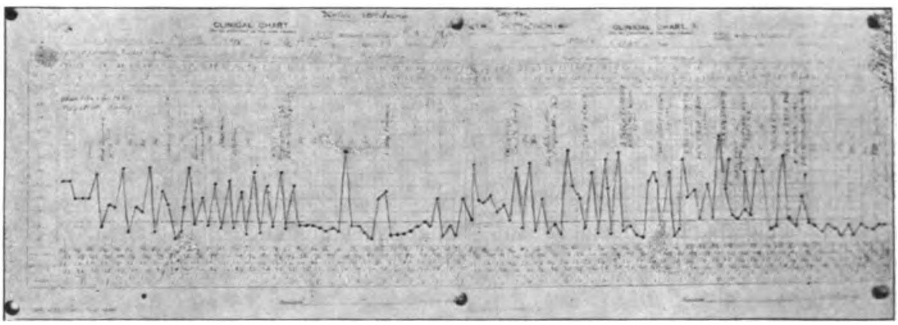


Fig. 1.—Temperature chart of the case from the third to the sixty-fourth day.

On April 3 a blood count was taken and showed leucocytosis of 17,500 per cubic millimetre, polymorphonuclear leucocytes 79 per cent, and lymphocytes 16 per cent. This suggested sepsis as the origin of the fever, but exhaustive clinical and laboratory tests of every organ and system failed to reveal any focus of infection, except in the mouth.

On April 14 I was asked to inspect the mouth of the patient. Clinical examination revealed generalized pyorrhœa, most of the pockets being about ¼ inch in depth, in spite of the fact that there was very slight œdema of the gums. The teeth showed marked loosening. The $\overline{4|}$ for instance was almost completely exfoliated and was eventually removed by the patient. There were five carious roots present and the whole mouth was in a very neglected condition.

Radiographical examination showed marked changes in the alveolar bone. Periapical rarefaction round the apex of the $\underline{|5}$ root (*see* fig. 2)

indicated the presence of a granuloma, and a similar condition existed around the apex of the ⌈6 root (fig. 3).

Complete loss of alveolus was revealed around the ⌈4 (fig. 3), and the 4⌉, these teeth being embedded merely in soft tissues. In the upper and lower incisor regions the interdental alveolar crests were destroyed for about half the length of the roots and the periodontal membranes showed definite thickening.

FIG. 2.

FIG. 3.

Prontosil treatment (one tablet t.i.d.) had been commenced on April 4, and the evening rises of temperature ceased for three days, but on April 8 the temperature rose to 103·8° F. It rose again on April 11, and on April 15 it rose to 105° F. The intermittent fever continued, the temperature being normal in the morning and going up to 103° F. or more in the evening. Occasionally the patient remained afebrile for one day.

On April 28, i.e. the forty-fourth day of the fever, the patient was very emaciated with pinched and toxic facies and had developed jaundice of moderate degree. He was placed on the "seriously ill" list, and on April 30 the medical officer in charge of the case consented to the removal of some of the infected teeth. Owing to the patient's extremely weak condition, he was not ambulatory. He was taken into the theatre, some of the gross sepsis was cleared away and ⌊56 roots and three roots in the 76⌋ region were removed under local infiltration anæsthesia with novocain. In spite of the jaundiced condition of the patient there was no prolonged bleeding. Twenty cubic centimetres of antistreptococcal serum were given intramuscularly on the day on which the extractions were done and the dose was repeated on May 2.

The evening rises in temperature still persisted. On May 5, the fifty-first day of the disease, the ⌈456 were extracted under regional anæsthesia. Twenty cubic centimetres of antistreptococcal serum were again given the following day. The patient was placed on the "dangerously ill" list on May 7. His temperature went up to 104·8° F., and he developed a serum rash all over the body. This was treated symptomatically and disappeared after two or three days. A blood count at this stage

gave total white cells as 11,250 per cubic millimetre, polymorphs 90 per cent, and lymphocytes 9 per cent. The temperature rose to 103° F. on May 10, 103° F. on May 12, and 100° F. on May 14. After this date there was no further rise in temperature. Thus in the nine days following the last group of extractions there were four rises in temperature, after which the patient remained completely afebrile.

The intermittent fever had persisted for sixty days, and not until the forty-sixth day had any serious attempt been made to clear up the oral condition. On the fifty-first day the second group of extractions was done, and on the sixtieth day the fever finally subsided.

The patient was kept under observation for seven weeks after the last rise in temperature, and during this time he remained afebrile, put on weight, and generally recuperated. When he was discharged from hospital on July 4 he had recovered normal health.

I wish to thank Lieutenant-Colonel R. L. Vance, I.M.S., O.C., C.I.M. Hospital, Razmak, for permission to submit these notes for publication.

Echoes of the Past.

SOME NOTES ON THE MEDICAL SERVICE OF THE RESTORATION ARMY.

By Lieutenant-Colonel G. A. Kempthorne, D.S.O.
Royal Army Medical Corps (R.P.).

When the "New Model" was disbanded after the Restoration the regular army maintained on the Home Establishment comprised three troops of Life Guards, a regiment of Foot Guards (the Grenadiers), the Coldstream (Monk's regiment of Foot), which survived from the Cromwellian army, and a newly-raised regiment of Horse (the Blues). There were also garrison companies varying in strength from a dozen to two hundred men permanently stationed in thirty-one fortresses. Scotland had its own army, which included the Scots Guards. The Royal Scots were at the time in the service of the King of France. The Irish Establishment of about 7,000 men was also a separate affair and was locally recruited. The West Indian and American colonies normally provided independent companies for their own defence. There was also a garrison at Dunkirk. Meanwhile, there were no less than three English and four Scottish regiments which had been in the service of the United Provinces since Elizabeth's reign and were still so serving.

The *Journal of the Society for Army Historical Research* of July, 1930, provides us with the original Medical Establishment in 1661. Each troop

of Life Guards had its surgeon, paid 6s. a day and 2s. horse allowance, the Regiment of Horse had one (4s. and 2s.), the two Infantry Regiments had each a surgeon (4s.) and mate (2s. 6d.). The garrisons of Tinmouth, Portsmouth, Jersey, Guernsey, and Berwick had surgeons of their own. There was a physician (15s.), and an apothecary, to the newly-raised forces.

On the King's marriage to Catharine of Braganza the following year, Tangier and Bombay came under the possession of the British crown. For Bombay, a company was raised by the East India Company, an ancestor of the Royal Dublin Fusiliers. Tangier was in constant danger of recapture by the Moors, and, for its defence, the Tangier regiment of Foot (the Queen's) and the Tangier Horse (1st Royal Dragoons) were raised. The Admiral's regiment of Marines, the Buffs, who returned from the Dutch service in 1665 and went to Tangier, and the King's Own raised in 1680, appear to complete the list of British regiments during Charles the Second's reign.

During the Commonwealth, some knowledge of the medical requirements of a standing army, both at home and in the field, had been acquired, often by bitter experience, as in the expedition to S. Domingo in 1654. It is clear from the Calendars of State Papers that military hospitals were established in Ireland, for which, in 1650, beds, drugs, cloth, spices, sugar, and confectionery were provided. Medicine chests costing £25 apiece were found for each unit, a horse to carry them, and an allowance to the surgeon to replenish them. In the previous year, Parliament directed that effectual means should be taken for the relief of maimed soldiers and widows and orphans of men slain on service, and that one or more hospitals should be prepared in Dublin and elsewhere for sick and maimed soldiers.[1]

By this time the days when the surgeon regarded the privilege of shaving the soldiers as one of his perquisites were long passed. The College of Barber Surgeons held a dignified and respected position. Robert Wiseman, the ex-naval surgeon and personal attendant of the King in the Civil War, who had done so much to raise the profession to this condition, was still living. Nevertheless the regimental medical officers were still regarded, Sir John Fortescue tells us, as the servants of the regimental commander, though they held the King's commission which they had purchased like other officers.

Before the passing of the Mutiny Act, army discipline was notoriously lax, but an offending officer could always be cashiered, thus forfeiting both his commission and any pay due to him. Partly for this reason, and partly for economy, a proportion of the officers' pay was kept several months in arrear.

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[1] Calendars of State Papers, Domestic, Jun. 1649.

A case of some interest is recorded in 1673 when the Surgeon-General wrote to Lord Arlington that Peregrine Ewell, the medical officer of Colonel Fitzgerald's regiment, had failed to embark with his unit, and that Colonel Hamilton, then in command, had cashiered him on his own responsibility. Colonel Hamilton died at sea, possibly, it was suggested, owing to lack of medical attention. The accused officer maintained that he was absent on urgent private affairs, that he had arranged for a locum, and anyhow his orders were for a different ship to that on which deceased embarked; moreover Surgeon-General Knight and Surgeon Pierce had a down on him because he had recovered a civil action against one of their friends. The Judge Advocate-General decided that as Ewell had been already cashiered he was not amenable to trial by court martial. Whatever the result, Ewell is found as surgeon of the 1st Royal Dragoons ten years later.

Apart from the defence of Tangier, borne mainly by the Queen's, the Buffs, and the Tangier Horse, detachments of the Guards were employed at different times in North America and the West Indies. In 1673 they provided a nucleus for a force of levies despatched under the Duke of Monmouth to join Turenne's army in the invasion of the Netherlands. Although the other operations of the Dutch Wars were purely naval in character, troops were constantly embarked on the men-of-war either to supplement the crews or as marines. Rupert and Albemarle, who held joint command in the second war, were both soldiers, and several of the subordinate commanders were army officers.

In preparation for the outbreak of hostilities, the King appointed four commissioners "to take care of such sick, wounded and prisoners as might be expected upon occasion of a succeeding war and action at sea, each being appointed to a particular district and with power to constitute officers, physicians, chirurgeons, and provost marshalls, and to dispose of half of the hospitals throughout England." The commissioner for Kent and Sussex was John Evelyn, the diarist, from whose writings we learn something about the proceedings of the commission. The patients were received in the first place in hired buildings near the coast, put into captured vessels, or more often apparently boarded out in private houses, which last was uneconomical owing to the unnecessary number of surgeons and attendants employed, and tended, Evelyn says, to debauchery. He strongly advocated the building of an infirmary. Disembarkation was carried out under the supervision of a regular officer appointed by the Surgeon-General or by the Surgeon-General himself.

It is evident that Evelyn took his duties seriously, being constantly up and down the coast on tours of inspection. It was not the commission's fault, or for want of continued representations on their part, that the lot of wounded and prisoners alike was often a miserable one; for, owing to lack of funds, they had to depend largely on private charity for their

subsistence. The plague, which broke out in 1665, greatly increased Evelyn's difficulties. It was estimated that the service, if properly carried out, required £2,000 a week, and meanwhile the Treasury was empty. The total debt of the Committee at the close of the war in 1667 was £34,000.

On the outbreak of the Third War in 1672, the members renewed their difficult task. In March, after the attack on the Dutch Smyrna Fleet, we find Evelyn at Chatham, where he watched the amputation of a seaman's leg, "the stout and gallant man enduring it with incredible patience without being bound to his chair as usual." He died of gangrene after a second amputation. The same week Evelyn was received by Surgeon-General Knight and Dr. Walrond at Margate, where he found "abundance of miserably wounded men."

When Tangier was evacuated by the garrison in 1684, the returning troops brought large numbers of sick with them who were attended by the Surgeon-General's deputy in the hospital established for sick and wounded seaman at Deal. Two years before, there is an entry in the Treasury Books of £138 to be allowed for poor soldiers from Tangier. The subsequent history of the men broken in these wars is not very clear. Before the Commonwealth they became like paupers, a charge on their parishes. Cromwell made them an allowance out of the confiscated royalist estates. An order made after the Restoration making them again chargeable to the parishes seems actually never to have been enforced. Kilmainham Hospital in Ireland was in course of erection in 1681, when a deduction was ordered from the pay of the officers and men of the Irish Establishment towards its upkeep. The foundation stone of Chelsea Hospital was laid by Charles II, but it seems to have been ten years before it was in operation. It provided for both in-pensioners and out-pensioners. Up to 1783, when a government grant was made, it was supported by a stoppage of a shilling in the pound per annum taken from the serving soldiers' pay.

The year of the accession of James II saw the landing of the Duke of Monmouth in the West and the Battle of Sedgemoor. The Militia was embodied, and all the available regular troops were concentrated on Hounslow Heath, including the lately withdrawn Tangier garrison. The camp remained a permanent one for the next three years. Here a military hospital was established which was regularly attended by James Pierce the Surgeon-General and Thomas Lawrence the Physician. A permanent building was provided for it at a cost of £1,115.

At the first encounter with the rebels near Philip's Norton, the royalist advance-guard suffered a reverse and had a hundred casualties. The wounded were sent into Bath where they were under the care of Surgeon George Bellamy till their removal to London. At Sedgemoor, the S.M.O. was probably Thomas Hobbes, M.O. of the 1st Life Guards and Staff

Surgeon to Lord Feversham. James Wylly of Kirke's Foot (the Queen's) and Henry Musto of the King's Own were present with their regiments and were subsequently in charge of 110 wounded at Bridgwater. No mercy was shown to the wounded prisoners. "Before evening 500 prisoners had been crowded into the Parish Church of Weston Zoyland, 80 of them were wounded and five expired within the consecrated walls. Great numbers of labourers were impressed for the purpose of burying the slain. A few who were notoriously partial to the vanquished side were set apart for the hideous task of quartering the captives. The tithing men of the neighbouring parishes were busied in setting up gibbets and providing chains. All this while the bells of Western Zoyland and Chedzoy rang joyously and the soldiers sang and rioted on the moor among the corpses."[1]

The services of all the surgeons above mentioned were brought to the favourable notice of the Treasury by the Surgeon-General, and he also raised the question of smart money for the wounded soldiers." [2]

Monmouth's rebellion afforded a good pretext for a further increase of the Army which was now augmented to 20 regiments of foot, 7 of horse, and 4 of dragoons. The names of most of the surgeons gazetted to the new units may be found in Dalton's Army Lists or more conveniently in Colonel Peterkin's List of Medical Officers.

James the Second deserved well of his country in his able administration of the Navy during his brother's reign. He might, had his own reign been prolonged, have done much the same for the Army. Unfortunately in other respects he was a quite impossible person, and, when William of Orange landed in 1688, the revolution which followed was carried through practically without opposition.

In the absence of further information regarding the Army Medical Service of this date, it may be of possible interest to enumerate some of the leading figures and what is known of their wives.

Timothy Clarke, M.D.Oxon, F.R.C.P., F.R.S., appointed Physician to the newly-raised forces at the Restoration, was a fellow passenger with Samuel Pepys on board the *Naseby* when she fetched the King home from Holland. The embarkation there was a stormy one and the physician was twice ducked in the sea. The two made great friends, and seem to have had a very merry voyage. The following month, Pepys dined with the Clarkes when he found his hostess "a comely proper woman though not handsome, but a woman of the best language I ever met." Discussing the return party with Mrs. Pepys, when the guests were to include James Pierce the surgeon and Mrs. Pierce, he was greatly troubled because Mrs. Pepys had only a taffeta dress while the other two ladies would certainly be in mohair, but he reached the conclusion that nothing could

[1] Macaulay. [2] Treasury Books, 1685-6.

be done about it. The party eventually consisted of the Pierces, Dr. Clarke, his lady, his sister, and a she cozen. The dinner and the supper which followed, costing Samuel in all £5, was voted by him a great success. He found Mrs. Clarke on this occasion "witty, though a little conceited and proud." Later his admiration cooled when, after calling at her house, he noted the vulgarity of the furniture and the poverty of the household stuff in comparison with his own "despite the show and flutter she makes in the world." Dr. Clarke died in 1672. His title seems to have remained "Physician to the Army."

In 1678 *Edward Warner, M.D. Padua, F.R.C.P.*, is styled Physician-General, the designation applied to Dr. William Currer in the Irish Establishment as far back as 1662. Warner was formerly medical officer to the Grenadier Guards. *Dr. Thomas Lawrence*, late physician to the garrison of Tangier and medical officer of the 2nd Foot, became Physician-General of the Land Forces in 1685. He served through King William's and Marlborough's campaigns and was knighted by Queen Ann.

John Knight, King's Sergeant Surgeon and a Warden of the Barber Surgeons' Company, was appointed in 1664 to be Surgeon-General of all the forces in England and Wales "to dispose of sick and wounded soldiers, see that they are well accommodated and attended, and to examine and appoint other surgeons and provide and distribute medicines." In 1666 he was dealing with naval medical appointments, and in 1673 represented the need for three or four able apothecaries to ensure the proper stocking of the ship's medicine chests. He was evidently, as was his successor, responsible for both services. As to the title, there was a Surgeon-General, James Fountain, in Ireland in 1661, and in 1662 Alexander Eristy was Surgeon-General of the hospital at Dunkirk. Possibly the style was at first used only under active service conditions. A "General's Surgeon" appears in the Establishment for the New Model. Knight died in 1680.

Sackville Whittle succeeded in 1680 when Knight died, but only held the post for a few months when he also died.

James Pierce, the next Surgeon-General, was a very old friend of Samuel Pepys. In the spring of the Restoration year he was surgeon to Colonel Ayre's regiment, then quartered at Cambridge. In March, 1661, he and his wife, whom Pepys greatly admired, dined with the family on the anniversary of Samuel's successful operation for stone. The party the following year has already been mentioned, "after which my wife and I did talk high, she against and I for Mrs. Pierce (that she was a beauty) till we were both angry."

In 1665 Pierce was appointed surgeon of the Buffs whom he must have joined at Tangier. His wife took a fine new house in Covent Garden and was a constant visitor. She was Samuel's valentine, and cost him twelve

pairs of gloves and a pair of silk stockings. In 1667 Pierce became surgeon of the Duke of York's troop of Life Guards. As the King's sergeant surgeon, he moved in court circles and was able to retail all the latest scandal, which much interested the Diarist. His commission as Surgeon-General was dated Feb. 21, 1681. He held his office through the reign of James II, but was replaced by a Dutchman, Van Loen, soon after the accession of William III. In 1671 we find him in straightened circumstances asking for some of his arrears of pay three years overdue. "La belle Pierce" then had a large family and was in poor health.

Richard Whittle is shown as Apothecary to the Army in the Establishment of 1661. As no salary is mentioned, we may perhaps assume that he was the official who arranged the contracts for drugs and dressings and made his profit on the commissions he received, which would be entirely in the spirit of the times. He is shown by Colonel Peterkin as Apothecary-General to an expeditionary force (Flanders ?), in 1673, and to the Army in 1685.

In 1662 *Robert Miller* was apothecary to the Hospital for Wounded Soldiers and Lepers in Ireland, which seems a rather unhappy combination. He became Apothecary-General there in 1671.

REGIMENTAL MEDICAL OFFICERS, 1685.

CAVALRY.—*Life Guards* (3 *troops*): Thomas Hobbs, William Mills, Gabriel Jones. *R.H.G.*: Thomas Sisum. *Queen's Horse* (*K.D.G.*): Alexander Hubin.* *Peterborough's Horse* (*2 D.G.*): Thorogood Meautys. *Plymouth's Horse* (*3 D.G.*): Thomas Deane. *Dover's Horse*: Pierce Coudroy. *Thanet's Horse*: Jacques Wiseman. *Arran's Horse*: Anthony Rousseau. *Shrewsbury's Horse* (*5 D.G.*): James Arden. *Princess Ann's Horse*: Robert Richardson. *Queen Dowager's Horse* (*6 D.G.*): George Bellamy,* John Skrymsher.

DRAGOONS.—*King's Own Royal Dg.* (*Royals*): . . . . .‡ *Queen's Dg.* (*3rd Hus.*): Noel l'Esveque. *Berkeley's Dg.* (*4th Hus.*): John Olivier. *Richard Hamilton's Dg.*: William Slingsby.

FOOT.—*1st Guards*: John Noades. *Coldstream*: Joseph Troutbeck. *Royal Scots*: Francis Beaulieu.* *Queen's*: James Wylie.* *Admiral's Regt.* Samuel Tatham. *Holland Regt.* (*Buffs*): James Pierce.† *Queen Consort's* (*King's Own*): Henry Musto.* *Royal Fusiliers*: Andrew Heriot. *Princess Ann's* (*King's Liverpool*): Francis Willoughby. *Cornwall's* (*Norfolk*): Samuel Ball. *Bath's* (*Lincoln*): . . . . *Beaufort's* (*Devon*): Philip Rose, Benjamin Hopkins. *Duke of Norfolk's* (*Suffolk*): John Rosse. *Huntingdon's* (*Somerset L.I.*): Claude Gillart. *Hales* (*W. Yorks*): William Govan. *Clifton's* (*E. Yorks*): Thomas Baker.

* Present at Sedgemoor. † Possibly one of the Surgeon-General's large family.
‡ Peregrine Ewell was surgeon in 1683.

SCOTTISH REGIMENTS.

SCOTS GUARDS.—John Baily, *H.M. Royal Dragoons* (*Greys*). James Irving, *King's Regt. of Horse.* Roderick Mackenzie, *Royal Scots* (as above). *Earl of Mar's Foot*: William Borthwick.

Travel.

KENYA.

By Lieutenant-Colonel F. S. GILLESPIE,
Royal Army Medical Corps.

(*Continued from page* 277).

February 13: We paid another visit to Thiba, this time fishing water that was very rarely fished as there was some doubt if it held any fish. Ivor and I went down and Ivy went up; we fished some fine pools with never a touch and eventually when we were fishing a long straight stretch I demonstrated the underhand cast to Ivor just as I had done to Ivy the previous day and got a nice 1½ pounder, rather pleasing to do it three times when one considers the hundreds of casts with no result. Ivor went down to a big pool a little farther on and I hope he tried the underhand cast, anyway he got a 2½ pounder in perfect condition. After lunch the rain came down in torrents and we bolted for home and just got sufficiently ahead of the storm to avoid having to put on chains.

February 14: We went out at 6.15 a.m. to the place where we had shot the lion but this time photography was our object; unfortunately we got no chances for whenever the wind was suitable for a stalk the sun was wrong for a photo, the only thing bagged was a lesser bustard for the pot.

February 15: The morning was spent packing up luggage which had to go down to Nairobi ahead of us. In the afternoon Ivor took us out about 15 miles to where we had shot the leopards and seen quantities of game six weeks before, including rhino and buffalo. What a change—the whole of the bush grass had been burned and the country was almost unrecognizable, and not a beast of any sort till we had gone about 15 miles and then only a few kongoni in the distance. I regretted all the chances of photographing kongoni which I had not taken for I never got a chance later.

February 16: Ivor and I set off in the Ford lorry provided by Government for official safaris, complete with tribal police, servants, tents and camp kit to a place on the Tana river, on the border of the district, to hold a tribal meeting. My part in the proceedings was the execution of hippo that had been damaging crops. We had a desperate drive of 20 odd miles from the main road across a plain where there was a track of sorts. The journey took about two hours and certainly was a tribute to the strength of the lorry and the skill of the driver. We saw some eland, zebra and

kongoni, but none near enough for really good pictures. The camp, half a mile from the Tana, was reached with some relief after our exceedingly bumpy trip. There was a large gathering of the local notables to meet Ivor and discuss some matters of local administration. I sat beside him and listened to the proceedings and took photos of chiefs and their followers when they weren't looking. In the evening we went along to deal with the hippo and saw plenty of signs of the damage done to maize crops. We sat over a pool hoping for a shot but saw precious little except an odd tip of a nose in the dusk as they came to the surface and snorted at us. Dinner on the tent veranda in the moonlight and then to bed, rather hoping to hear a lion roar, but again no luck.

February 17: Up at 5.30 to visit the same pool but this time there was not even a nose tip to be seen. I fancy they had got our wind and were running no risks. We couldn't cross the river so there was no chance of getting to a more favourable position. The only incident was a most ferocious attack by a colony of black ants which necessitated the rapid removal of my shorts and undergarments before I could get rid of them. Ivor was most scornful when I admitted that they were black ants as apparently the red variety are much fiercer. I have no ambition to try. We packed up after breakfast and started the return trip, very poor fun, and we were very glad to get on to the main road and back to Embu for lunch. A final game of golf in the evening in which Ivor avenged a couple of lucky victories of mine.

February 18: Ivy and I set off immediately after breakfast for our last day on the Thiba; unfortunately it wasn't a great success. I got two of about 1 pound, lost a very nice one on a spoon through a hook straightening out, and then lost four or five in rapid succession, all nice fish, and it was only when it was time to start for home that I discovered that the barb had broken off my hook; we left the Thiba with regret as we had had some delightful days on it.

February 19: Ivor and I set off after lunch to Karie, about 35 miles away, where we had had such a successful afternoon's shooting before. Birds were plentiful but a combination of bad beaters and bad shooting resulted in a mediocre bag of six francolin and a lesser bustard.

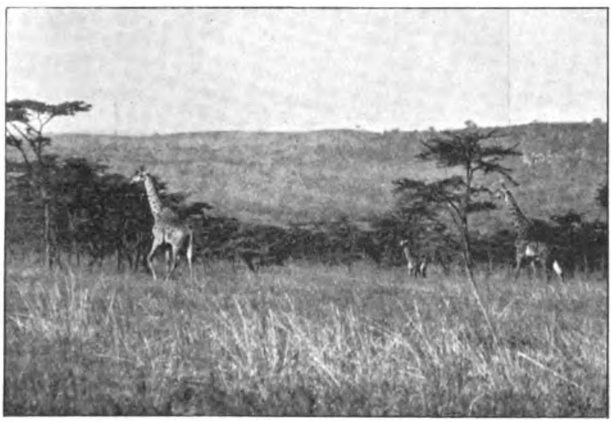
February 20: We set off at 9.30 for Nairobi and after a call on the Cox family at Thika, arrived at 2.30. After picking up my young nephew from his school we set off on a final game photographing trip, as far as Kenya was concerned, and went out about 25 miles to the back of the Ngong Hills when we were fortunate enough to come on two herds of giraffe, of which I got some excellent photos.

February 21: We left at 10 o'clock on the first stage of our journey by rail to Namasagali in Uganda. The first part of the journey was through country we had been through by car, down into the Rift Valley and

through Nakuru and Eldoret, seeing plenty of game quite close to the railway.

February 22: We arrived at Namasagali about noon and embarked on s.s. "Grant" for our next stage, down a section of the Victoria Nile into Lake Kioga to Masindi, all in Uganda. This was an uneventful trip, pushing six barges ahead of our stern wheeler. We passed through a bit of country in Uganda which was being visited by a plague of locusts and every bit of edible greenstuff was stripped from trees and plants, where locusts in millions were feeding. Nature's method of balancing the plague was provided by thousands of storks who seemed so replete from gorging on locusts that they could hardly move.

We saw a number of storks in Kenya and Uganda taking advantage of bush fires by walking about in the ashes feeding on partly cooked insects.



Giraffe in N'Goog Hills near Nairobi.

February 23: Reached Masindi Port at 8 a.m. and got away at 9.15 for Butiaba, about 75 miles off, stopping at Masindi Town *en route* where we picked up J. L. Somerville, who had been on the "Llandaff Castle" with us; he was bound for Cairo also. The road journey was done in an excellent bus over very good roads, far superior to most of those in Kenya. The country was intensively cultivated with cotton, maize, millet, tapioca and then coffee, rubber being chiefly grown by a combine of Scottish families, one section of the road being locally known as Caledonian Road on this account.

We met the wife of one of these planters on the river steamer and she gave us an interesting account of their activities; buying cotton all over the northern part of Uganda and a good part of southern Sudan. At Butiaba after a drive down a steep escarpment we embarked on s.s. "Robert Coryndon," a twin screw steamer of over 800 tons, which had been exported from home in sections, railed up from Mombasa and assembled

at Butiaba for service on Lake Albert, which has an area of over 2,000 square miles. We didn't stay long on the "Coryndon," for we were met at the river mouth by a stern wheeler, the s.s. "Lugard," which was to take

Murchison Falls on Victoria Nile.

Crocodiles on Victoria Nile below Murchison Falls.

us up the Victoria Nile to the Murchison Falls and then back to Lake Albert and down the Albert Nile to Nimule on the Uganda-Sudan border. The Murchison Falls trip was intensely interesting and we saw any amount

of game, crocodiles so big that they seemed almost too ungainly to waddle off the bank, in fact many of them didn't bother to do so. Many lay on the banks with their mouths open for birds to pick their teeth of the debris of the last meal. Hippo we saw literally in hundreds with their big rather ridiculous looking pink snouts; they paid us little attention, knowing full well they were in a game reserve and quite safe. We saw several small herds of elephant but unfortunately none was close enough for a photo, and the hippo never seemed to be on the bank except when the light was too poor for photography. The Cox family had been on the previous trip, a fortnight before, and had seen elephant quite close and got within a few yards of a large crocodile on the bank, under the cover of a Game Scout's rifle.

We spent the night anchored a couple of miles below the Falls with hippo snorting and splashing all round us and crocodiles swimming about in the light of our searchlight.

February 24: We set off at 6 a.m. for the rest of the journey to the Falls and disturbed two buffalos drinking and two hippos just returning to the river after a night's feed on shore. They completely lost their heads and instead of plunging into the river, as they usually do, they galloped along the bank through the bushes, and a galloping hippo is a most absurd sight, the buffalo moved off at a very dignified walk. We had a walk of about 1½ miles up to the Falls and were accompanied by a Game Scout armed with a ·404 Mauser in case any of the local fauna interfered with us. Parties have occasionally met elephants or buffaloes and twice the Scout has had to shoot. Our trip was quite uneventful and the path was evidently not the same as Major Cheyne's perilous one described recently. The Falls were a most inspiring sight, not very high but the river which is about 200 yards across above the Falls, crashes through a rocky gorge about 35 feet across and 100 yards long and out into a wide cliff-bound pool with rocky islets where crocodiles and hippo were sunning themselves, and in the distance we could see the "Lugard" anchored, awaiting our return. A number of films were exposed and some excellent photos resulted. The sun was well up and the return journey was pretty warm. We rowed over to a bank on which a number of crocodiles lay asleep but they didn't give us the chance of a photo. The only one we got was a clutch of a dozen crocodile eggs which the boatmen dug up out of the sand; one was opened and had a completely formed baby crocodile inside. The trip down river to lake Albert was full of interest—elephant, hippo, water buck, and impala at intervals; we must have seen close on 80 elephants in all. The "Robert Coryndon" met us and took off some of our passengers who were going south and put on a few going north and we set off down the Albert Nile for Nimule.

February 25: Arrived at Rhino Camp at 6 a.m.—a very busy port at

this time of the year when cotton ginning was in full swing; there was a large ginnery going at full pressure. It was Rhino Camp's market day and hundreds of people were flocking in with produce from all directions—evil smelling dried fish, maize, bananas and the like. The women, who seemed to do all the work, were very lightly clad; Kipling's "Nothing much before and rather less than half of that behind," would describe it aptly enough, but still it was a suitable kit for the climate. We made arrangements with a local native to show us a white rhino; a few of these huge beasts still exist in this area and we were assured they were quite close by; however, it was only after one and a quarter hour's hard walking that Dr. and Mrs. Cole, the Hon. Miss D. Pickford, Ivy and I got into suitable bush for our escort to start his search in earnest. We weren't very hopeful, but in a short time he came back and beckoned us on and eventually showed us an immense rhino lying under a tree. He had an idea we were there, though we were down wind of him, for he got up and advanced in our direction. We had been assured that white rhino were quite tame but as I had nothing except my penknife and a pair of somewhat weary legs to save me, I didn't run any risks and exposed a couple of films at long range and then suggested beer on board the "Lugard" and retreated in good order. The journey back was very hot and the beer was grand. We called at Laropie and a couple of small ports during the afternoon where hundreds of bales of cotton were loaded.

(*To be continued*).

Current Literature.

BURNET, F. M., and LUSH, D. **Studies of Antibody Content in Human Sera: Life-story of Simple Herpes.** *Lancet*, March 18, 1939.

Clinically herpes falls into two main groups, idiopathic and symptomatic. After the causal agent had been shown to be a filterable virus present in the fluid of the vesicles, idiopathic cases were supposed to be due to infection from without. Two hypotheses were put forward for symptomatic cases: first, that these sufferers are carriers of herpetic virus which is activated by conditions such as pneumonia, malaria, and protein shock; secondly, that the primary disease causes the evolution of herpes *de novo*. In 1922 Levaditi, Harvier and Nicolau demonstrated the presence of herpes virus in the saliva of healthy persons, and two years later Busacca isolated it from the conjunctival sac. The existence of carriers of herpes virus was thus proved, and it was then found that two-thirds of the population have herpetic antibody in their serum. Andrewes and Carmichael showed there was a close relation between recurrent herpes and the possession of herpetic antibody.

Making use of the egg-membrane technique, Burnet and Lush con-

firmed the widespread existence of herpetic antibody and, like Andrewes and Carmichael, observed that the people examined had either much of the antibody or none at all; there is no intermediate group. This finding can only be explained by the assumption that those who are infected with herpes become permanent carriers. It is the persons possessing antibody who carry the virus and are subject to recurrent attacks of herpes, and primary infection probably takes place in the early years of life: if it is avoided at that time age brings increasing resistance, as through some change the mucous membranes become insusceptible to the implantation of herpes virus. Dodd, Johnston and Buddingh have shown that aphthous stomatitis in infants and young children is caused by the herpes virus. To sum up the discoveries of the last ten years, it may be said primary herpetic infection, commonly in the form of stomatitis, occurs in early childhood, and the person thus infected becomes a permanent carrier. If a child escapes infection in the first decade the chance of herpes virus being implanted later becomes remote, the carrier state is never set up and symptomatic herpes will never develop. In carriers an attack of herpes is attributable to an upset of the balance between host and virus—by infection, worry, fatigue, or menstruation.

The virus in the carrier is supposed to persist in the cells of the affected mucous membrane, or it may take up permanent quarters in the sensory ganglia. Burnet and Lush favoured the second hypothesis, but they were unable to isolate herpes virus from the gasserian ganglia of individuals who possessed high herpetic antibody and were therefore carriers. The persistence of herpetic virus in nervous tissue seems unlikely. In herpes zoster multiplication of the virus in the posterior spinal root ganglion is almost always attended with great pain, whereas there is no such pain in herpetic eruptions except in those rare cases where herpes simplex simulates herpes zoster. Further, the virus of herpes simplex has been recovered from the mouth between herpetic attacks.

These facts seemed to be best explained by assuming that the virus persists in the cells of the mucous membrane.

THULLIEZ. Le Service Médical de l'Aéronautique. [**Physiology of Aviation.**] *Arch. Belges Serv. Santé de l'Armée.* 1938, v. 91, 145-68, 1 chart.

The author summarizes the inherent problems as follows: Man is not made for flying. The practice of flying necessitates the subjection of his structure to a series of conditions unfavourable to existence.

The author considers, first, the hygiene of the aviator in flight and, secondly, the hygiene of the aviator on the ground. The influence of the atmosphere on the flying man is considered under four headings: temperature, humidity, pressure, and ventilation. The influence of the machine on the man is considered under the headings: noise and vibration; speed

(and acceleration); engine fumes. There is also the inherent condition of nervous tension in the aviator himself.

Considering in detail the effects of these influences on the man, the author points out that the effects of cold at great heights is accentuated by air movement and that cold is accountable for several maladies. The rapid changes in humidity experienced whilst flying are said to be over-stimulating and to provoke sneezing. Decrease in atmospheric pressure with altitude results in a lessened partial pressure of oxygen in the air breathed and in the symptoms of oxygen want—rapid pulse, increased respiration and changes in arterial blood-pressure. The system takes time to adapt itself to the changes produced by a rapid rise to great heights. Ear and nose pains and bleeding are much more serious if the aviator has any kind of nasal inflammation. Excessive air movement over the head tends to desiccate the mucosa of mouth and nose. Noise and vibrations cause an "acoustic" dazzling of the senses resulting in the semi-deafness noticeable in pilots and passengers on landing. The effects of speed are evident in increased air movement (ventilation) and the great centrifugal forces that pull on every part of the body during turns at very high speeds, either in the vertical or horizontal planes. In modern flying an aviator weighing 70 kilogrammes will be pressed into his seat with a force of 825 kilogrammes. All the organs and the blood in the body are forced down with the same acceleration. This explains impaired vision and "blackouts."

Flying sickness or Aviator's Fatigue (Asthénie des Aviateurs) is described and corresponds very much to the general condition known as neurasthenia.

The paper continues with descriptions of and suggestions for combating the various causes of distress to flying men. Suitable clothing is important and may be electrically warmed, but so far no provision is known against rapid changes in humidity, although these are regarded as important by the author.

Oxygen can be supplied to compensate for the reduced partial pressure at great heights, whilst the ears may be protected by making frequent swallowing movements or by blowing down the nose with the fingers placed in the nostrils. Air pressure-tight cockpits are unsuitable for fighting aeroplanes.

Protection against speed has been tried by some foreign services by placing the pilot in a prone position. [Visitors to the Science Museum, South Kensington, will observe that the Wright brothers flew head first, but this was to reduce wind drag, not to avoid centrifugal effects.]

The only protection against nervous strain is to be found in the strict observance of the rules of health when on the ground and the avoidance of all excesses.

T. C. Angus.

Reprinted from "Bulletin of Hygiene," Vol. **14**, ***No.*** 1.

WILSON, W. J. **Isolation of *Bact. typhosum* by Means of Bismuth Sulphite Medium in Water- and Milk-borne Epidemics.** *J. Hygiene.* 1938, v. 38, 507-19. [34 refs.]

This paper contains a series of miscellaneous observations of considerable interest.

(*a*) During a milk-borne outbreak of typhoid fever in a mental hospital *Bact. typhosum* was isolated from two workers in the dairy. They were removed, and the outbreak ceased. One of these workers developed typhoid fever four and a half months later. "Precocious carriers" of typhoid bacilli, who developed enteric fever a short time after their condition had been detected, have been reported by previous workers, but this particular instance of the development of enteric fever in a person who had been carrying the bacilli for at least four and a half months is particularly striking. The author considers that this type of carrier may be of epidemiological importance. He suggests that "Mrs. A," in the Bournemouth-Poole milk epidemic of 1936, may have belonged to this class.

(*b*) From a sewage-contaminated water supply a strain of typhoid bacillus was isolated that formed dwarf colonies on agar, yet which was agglutinated to full titre by an antityphoid serum. About a fortnight later an inmate of the house supplied with this particular water developed typhoid fever, and from her stools typical dwarf colonies of the typhoid bacillus were isolated. This appears to be a unique instance of the isolation of typhoid bacilli from a water supply just before a consumer of the water contracted the disease.

(*c*) From a well supplying an infirmary in which an outbreak of enteric fever had occurred typhoid bacilli were cultivated on four separate occasions during a space of just over four weeks. This was apparently an instance in which the well was being continually re-infected from contaminated ground water. In one sample of water, which had been presumably kept at atmospheric temperature, three typhoid bacilli per 100 cubic centimetres were found after the bottle had been standing for a week.

(*d*) A sudden outbreak of typhoid fever in September, 1935, in Belfast, was traced to an infected milk supply. Over 100 cases were admitted to hospital. In a stream passing through the yard of the dairy 300 typhoid bacilli per cubic centimetre were found. The pollution of the stream was traced to the escape of sewage from a broken drain coming from a row of adjoining houses. Exactly how the milk became infected from the stream could not be ascertained, but as in the Bournemouth-Poole outbreak the milk did undoubtedly become infected.

(*e*) Modifications are described in the preparation of the bismuth sulphite medium, and useful suggestions are made for the isolation of the typhoid bacillus. Methods for the quantitative estimation of *Bact. coli* and *Cl. welchii* are also described. G. S. WILSON.

Reprinted from "Bulletin of Hygiene," Vol. 14, *No.* 1.

Leathart, P. W. **The Biological Significance of the Tonsils and Adenoids and Other External Lymphoid Masses.** *Brit. M. J.* 1938, Oct. 22, 835-6.

"Tonsils and adenoids" for more than a generation have been recognized as indicators of a struggle by the organism against factors of ill-health, the causes of which must be sought out and removed, as a public task.

Eighteen years ago Leathart adduced reasons for considering this affection as due to an infectious disease. Since then he has studied the subject in its biological aspect, and there emerges a picture of what he calls "external lymphoid masses" in contact with the outer world, permitting the growth of certain organisms against which the system needs to acquire "auto-immunization." Most of the older scholars gain an immunization through this, with one result, that atrophy often succeeds the earlier hypertrophy seen in many tonsils.

This view co-ordinates various public health aspects of these hypertrophies in young children. They are then understood as reactions by organs of biological value; and conservative rather than surgical treatment gains importance.

With complications such as nasal obstruction, from rhinitis or catarrhal sinusitis, the well-known effect of a daily dose of one or two grains of potassium iodide is suggested, to be followed for three months. This "nasal aperient" acts by reducing about 70 per cent of these complicated cases to the condition of simple tonsillar hypertrophy without nasal obstruction.

Where recurrent tonsillitis happens, especially in older children, it is justifiable to conclude that immunity is unobtainable; so, too, with chronic catarrhal otitis media, or otorrhœa; cases of rheumatic fever also, or nephritis, with tonsillar affection, which are not reacting to treatment, also require tonsillectomy for improvement.

The record of these Liverpool observations is well worth reading in full, in that it offers a rational working basis in regard to widespread indications of ill-health. Relief by operation is seen as less important than prevention by dilution of the infective causes. For this reason room to live in and play in, active sport in the open air and the swimming bath, become more important for young children. These things are worthy of special consideration, for any public money spent on the health of children should return greater national value than if spent on adults.

James Kerr.

Reprinted from "Bulletin of Hygiene," Vol. 14, No. 2.

Reviews.

SURGICAL HANDBOOK FOR HOSPITAL ASSISTANTS IN THE TROPICS. By W. K. Connell, M.B., Ch.B., F.R.C.S., D.T.M. & H. 1938. Pp. 440, 177 figs. London: John Bale Medical Publications, Ltd. Price 12s. 6d.

Written primarily as a ready reference for native dispensers and sub-assistant surgeons in his (the Colonial—African) service, this book will not only make a special appeal to those of our officers who have worked with similar grade of subordinates in India, but should also prove very useful to officers who have to train our own senior N.C.O.s. One finds oneself in complete sympathy with the author in the task he has set himself, and he is to be congratulated on the result. On the whole the subject matter is presented in a simple straightforward way, and many of the semi-diagramatic illustrations are excellent, and could be understood by the most backward. Such typographical errors as exist will surely be corrected in future editions. One would prefer to see that beasts which have died of "splenic fever" (anthrax) should be burned rather than buried (p. 62)—and acute synovitis due to mechanical injury classified under injuries, thus clearly differentiating such things as the old unscientific "synovitis-knee, etc." from similar inflammation due to toxæmia or bacterial invasion. One also wonders how modern pharmacologists and physicians would react on reading the vague term "stomachic"? (p. 67).

This is a first-rate book, and the Corps Training Manual might well borrow some of the illustrations. D. C. M.

ALCOHOL AND HUMAN LIFE. By Courtenay C. Weeks, M.R.C.S., L.R.C.P. Second Edition. 1938. Pp. x + 454. London: H. K. Lewis and Co., Ltd. Price 6s. net.

One's eyes are often confronted with the slogans "Beer is Best" and "Guinness is good for you." The author of this book does not agree; in fact he is convinced that alcohol is very bad for you, and is prepared to prove it from many angles.

The book ranges from a thirty-page discussion of the various theories to explain the mode of action of narcotics on living cells and twenty-four pages on "The child and racial poisons" to such comparatively simple matters as the effect of alcohol on road accidents or its percentage in a cocktail, "the demoniacal vanquisher of youthful virtue."

The book is described as being partly a revision of Horsley's "Alcohol and the Human Body," but it contains much new work, and the author is to be congratulated on the zeal with which he has collected in a small space such a mass of information on the subject. Not everyone will agree

with his views on the effects of moderate consumption of alcohol, but for anyone who wishes to wage war on the poison Dr. Weeks has provided a veritable arsenal of munitions. C. M. F.

CARDIOVASCULAR DISEASE IN GENERAL PRACTICE. By Terence East, D.M., F.R.C.P., Physician-in-Charge of Cardiological Department, King's College Hospital, London. 1938. Pp. 206. London: H. K. Lewis and Co., Ltd. Price 10s. 6d.

This small volume is written for the general practitioner and deals with the main features of disease of the cardiovascular system in a simple and practical manner. Some of the more recent means of investigation are not dealt with in any detail for, as the author points out, these methods may not be available for the man at the bedside. A careful history of previous illnesses and inquiry into the symptoms complained of is often even more useful than so-called instrumental records of the function of the cardiac muscles. Dr. East has emphasized this point and shows how much may be learnt from a careful clinical examination of the patient. In Chapter III, heart-failure is considered and the diagnosis of right from left ventricular failure is dealt with.

Treatment of the various cardiac conditions is set out in an adequate manner. Detailed schemes of diets are given and instruction for the arrangement of graduated exercises during convalescence.

This book can be confidently recommended as a good practical work on Cardiology.

A TREATISE ON HYGIENE AND PUBLIC HEALTH, WITH SPECIAL REFERENCE TO THE TROPICS. By Birendra Nath Ghosh, M.B.E., F.R.F.P. & S.Glas. Ninth Edition. London: Simpkin Marshall, Ltd.; Calcutta: Scientific Publishing Co. Price Rs. 8/8, or 15s. net.

The ninth edition of this valuable book lives up to and beyond the reputation of its predecessors. The whole book has been revised and two new chapters on Mental Hygiene and Mental Disorders have been included.

The monographs on Relapsing Fever, Typhus Fever, Beri-Beri and Epidemic Dropsy have been re-written by Major-General Sir John Megaw, K.C.I.E., while the chapter on Maternity and Child Welfare has been similarly dealt with by Dr. Jean M. Orkney.

The book cannot fail to be of immense assistance to those interested in hygiene and particularly to those whose responsibilities lie in connection with public health in the tropics.

In a book so admirably and logically put together, it seems invidious to pick out any sections for special mention, but it is difficult to avoid bestowing special praise on the author for his treatment of food and diet with special reference to India, and for his chapters on water, soil, and animal parasites.

There are no major criticisms to be made, and but few of the minor sort. One might, however, suggest that more stress should have been laid on the importance of the one-pipe system of house drainage, and that in connection with steam disinfection the need for the employment of the downward displacement method in all current steam apparatus including the Serbian barrel of which a diagram is given, should have been emphasized.

Perhaps also in reference to the bacteriological examination of milk supplies some mention should have been made of the methylene blue test.

Any criticisms that can be offered are, however, as raindrops in an ocean of praise and the book can be recommended with the greatest confidence for inclusion in the armamentarium of the public health student or practitioner whether tropical in his hygienic predilections or not.

A. E. R.

GRAY'S ANATOMY, DESCRIPTIVE AND APPLIED. Edited by T. B. Johnston, M.D., assisted by J. Whillis, M.D., M.S. Twenty-seventh Edition. 1938. Pp. xxxii + 1536, with 1336 illustrations, of which 624 are coloured, and 29 are X-ray plates. London: Longmans, Green and Co., Ltd. Price 45s. net.

A new edition, the twenty-seventh, of Gray's Anatomy, has just been published. The first edition of this work appeared in 1858, and under the guidance of the present editors, Professor T. B. Johnston, M.D., assisted by Mr. J. Whillis, M.D., M.S., both of the School of Anatomy at Guy's Hospital, the present edition retains the outstanding place won by its predecessors amongst generations of medical men.

In an interesting note on the original author, Henry Gray, we learn that his first edition contained 750 pages and 363 figures, and that he himself prepared a second edition two years after the first.

This twenty-seventh edition with its index, has over twice as many pages as the first and nearly 1000 extra illustrations. The sections on Arthrology and the Lymphatic System have been almost entirely re-written, and portions of other sections have also been re-written in the present edition.

The suggestion made in this Journal by the reviewer of the twenty-sixth edition, that a colour process could be used with advantage in the Myology section to clarify the pictorial relationships between muscles and their tendons, has been adopted in this edition, and has in our view fully justified itself.

We number ourselves amongst those who considered that the inclusion of X-ray photographs was overdue, and we welcome their appearance now.

There must remain little new to be said about Gray's Anatomy. Its already assured position is consolidated by the present edition, and the editors and publishers are again to be congratulated. D. C. M.

EDITORIAL NOTICES

The Editor will be glad to receive original communications upon professional subjects, travel, and personal experiences, etc.

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No. 6. June, 1939. Vol. LXXII.

Journal of the Royal Army Medical Corps

IN ARDUIS FIDELIS

ISSUED MONTHLY

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Price Two Shillings and Sixpence net

VOL. LXXII JUNE, 1939. No. 6

Journal
of the
Royal Army Medical Corps.

Original Communications.

MALNUTRITION—A SURVEY.

BY MAJOR A. E. RICHMOND, O.B.E.,
Royal Army Medical Corps.

THE subject of malnutrition is one which has achieved considerable prominence in the past few years and which merits the attention that is being given to it in this and other countries.

It is a matter of great importance in military as well as civil life, especially in its application to the younger generation, and should receive our very serious consideration.

The study of malnutrition is unfortunately hampered owing to difficulties of accurate definition and assessment, but these are being overcome to a material extent, and much additional knowledge of the subject has resulted from the investigations carried out in recent years.

Some authorities make a distinction between undernourishment due to sheer lack of calorie value in the diet and malnutrition which is so often due to the lack of a sufficiency of protective elements in the food ingested. Such a distinction appears illogical and it is difficult to find any valid reason for not regarding such undernourishment as a form of malnutrition.

It must be borne in mind, however, that though dietetic factors are of great moment in the causation of malnutrition, this condition may be due to other causes such as lack of sleep and of recreation and fresh air, unhappiness, malabsorption of food-stuffs, inadequate blood oxygenation and other circumstances, all of which, severally or in combination, may have to be taken into account in different cases.

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It is advisable to make a distinction between primary and secondary malnutrition, the former being an original condition of which the development has not been due to any previous disease or disability, and the latter comprising a manifestation which is secondary to some definite and primary disease.

Primary malnutrition is undoubtedly a half-way house to frank disease. The child who suffers from it is more liable to infection, and, whether he escapes this contingency or not, will be adversely affected as regards his development, both mental and physical, and will often fail to attain that fullness of life which should be his heritage, and that degree of ability and capacity for work and play which he should possess.

The early recognition therefore of malnutrition and its treatment are likely to be of the highest importance in the prevention of disease and in assisting the maximum development of the child. Moreover, assuming the excessive prevalence of the condition, such early recognition and treatment will be of material help in raising the standard of health of the nation in the present and future generations.

The detection and, still more, the accurate assessment of a condition in the individual the nature of which is, to say the least of it, indefinite, is bound to be difficult, but we have available one method which, pending the discovery of a more satisfactory substitute, takes us some way along the road, and this is known as the method of clinical assessment. It was prescribed by the Board of Education in a circular of 1934 for use in connexion with the school medical services, and recommends that in the examination of a child for the presence or absence of malnutrition his general appearance should be noted.

Attention should be given to the facies, carriage, posture, and to the condition of the mucous membranes, while the muscular tone and the amount of subcutaneous fat must be observed. It is the dull listless child with a muddy complexion which is the typically malnourished individual in contradistinction to the alert, cheerful child with bright eyes and a good colour.

Carious teeth and other local defects may be signs of malnutrition, but should not alone be taken as evidence of its presence as any single sign may lead to error. It is essentially the general impression that decides the issue.

A method of this kind dependent upon the mental impressions of different persons with different views and experiences and not upon measurable standards cannot be perfect, but it affords the best means of assessment open to us at present, and after examination in the way referred to the child is classified in one of the following groups:—

A.—Excellent.

B.—Normal.

C.—Slightly subnormal.
D.—Bad.

It should be noted that this classification is incorporated in Army Form C. 319, the form of medical examination which has to be completed at the ages of 5, 8, 11, and 13 years in the case of all Army school children.

A simple test which may be looked upon as subsidiary to the clinical method is known as the sign of the dorsal median furrow. Here, with the child's arms held straight above the head, the median dorsal furrow is noted together with the posture. A broken or sinuous furrow is a sign of malnutrition, but is difficult to assess mathematically. Certain observers consider this sign to be of definite value, and this opinion has been to some extent confirmed by observations made at the Recruits Physical Development Depot at Canterbury by the Officer in Medical Charge of this establishment for the conditioning of sub-standard recruits.

The essential features of the clinical method of assessment having been described, we will turn our attention to a small number of additional tests out of a very large number which have been made the subject of investigation by numerous workers.

These tests are selected as being those most likely to be of practical value, since considered in conjunction with the clinical test, they will aid the detection of cases of malnutrition, especially of the slight and borderline type which might otherwise escape recognition.

These methods of assessment may be categorized in a simple manner as follows [1]:—

(1) Somatometric.
(2) Physiological: (*a*) Specific; (*b*) Non-specific.

As regards somatometric tests, investigations have been carried out by various observers on lines of this nature, and numerous formulæ which take into account height, weight, chest and other measurements have been evolved, some simple and some complicated.

No combination of measurements, however, has emerged or is likely to emerge as an infallible means of nutritional assessment, but on the other hand certain measurements may be stated to be of definite assistance in this direction when studied in conjunction with the clinical method.

The height/weight ratio is a simple and comparatively useful index, but recent investigations by Huws Jones [2] appear to have established Tuxford's index as even more valuable, and it is claimed that the application of this formula allows of the picking out of 75 per cent of children assessed as subnormal by two or more doctors, whereas the average school medical officer would only be able to recognize some 66 per cent. This is tantamount to the index referred to being considerably more effective in

assessment than some doctors, and no doctor being materially superior to the index.

The formula referred to is as follows:—

Boys— $$\frac{\text{Weight (in grammes)}}{\text{Height (in centimetres)}} \times \frac{(381\text{—age in months})}{54}$$

Girls— $$\frac{\text{Weight (in grammes)}}{\text{Height (in centimetres)}} \times \frac{(354\text{—age in months})}{48}$$

and for average children the index is found to be about 1,000. It is suggested that any child with an index below 970 should be looked upon with suspicion.

Some points of a general nature are of moment in connexion with somatometric tests and should receive consideration.

In the first place in contradistinction to certain of the physiological tests to be mentioned later, they are comparatively easy of application to children in bulk and they are of particular value in studying the trend of the mean weight and height of children and adults in the same social group from year to year or in comparing the figures obtained in the same period in different social groups.

In the second place whatever somatometric formulæ are used, the taking of single readings at comparatively long intervals is of little assistance and the greatest value from them is to be obtained by regular measurements at six-monthly intervals or less. In this connexion it is suggested that, as is the practice with the L.C.C. school children, each child should have a chart on which his or her index value is graphed at each six-monthly measurement, and in addition the minimum allowable index value is also shown.

This arrangement allows of the visual detection of a drop in the child's index value towards the minimum line, and permits the taking of any necessary steps to prevent a further fall.

As regards specific physiological tests it is probable that the estimation of hæmoglobin is as useful as any and is applicable within reason to the examination of children in bulk.

The rationale of the test is that some degree of anæmia is a common accompaniment of vitamin deficiencies in the diet.

It is, of course, essential to exclude any morbid cause for the anæmia and it should be noted also that in certain children with a definitely anæmic appearance a hæmoglobin figure of more than 100 may be discovered.

It might be well also to mention that the Hellige Neoplan hæmoglobinometer probably allows of more accurate and rapid readings than do other types of apparatus of this nature.

It is not contended that the estimation of hæmoglobin is a means on its own of establishing the existence of malnutrition in a child, but it will

in a proportion of cases afford confirmatory evidence of such a condition, and it is possible that with further investigations its value may prove even greater than appears at present.

Other specific physiological tests to be mentioned are used for detecting the existence of what are described as vitamin predeficiencies. They have on the whole the disadvantage that they are not applicable to bulk examinations of children, and are likely to prove of greater worth in connexion with special cases in which it is particularly desirable that the presence of early stages of vitamin deficiencies should be established.

These tests, moreover, are largely still in the experimental stage. They are, however, referred to as, apart from the interesting field of investigation they represent, they may be found useful.

Predeficiency in vitamin C is as important as many other factors in the causation of malnutrition and for its detection certain methods are open to us. Of these, tests for vascular fragility are reasonably easy to apply.

The arterioles, venules and capillaries in certain pathological states (hæmophilic and scorbutic syndromes) become comparatively fragile with the formation of petechiæ, but in the case of a latent deficiency of vitamin C in order to produce petechiæ some moderate distension is necessary.

This is the principle of Hess's technique in which by a pneumatic sleeve compression is maintained at 100 mm. of mercury for three minutes. If in that part of the arm subjected to stasis there are not less than ten petechial spots, it may be considered that abnormal fragility exists.

Hecht's modification [3] with certain recent improvements [4] is an advance on the foregoing test and in this a specific degree of depression is produced for thirty seconds by means of a cupping glass pressed on wet skin at the bend of the elbow. The maximum depression which can be used without producing petechiæ and the minimum depression which causes them to appear can be ascertained.

The resistance of vessels is normal if they can stand suction for thirty minutes at a barometric pressure of 175 to 350 mm. of mercury. This test is a useful one when considered in conjunction with others, and if it is realized that causes other than dietetic may at times produce the sign which is the basis of the test. It is also simple, painless, rapid and accurate.

The vitamin-C content of the blood may be estimated in the laboratory. In this connexion it is stated [5] that when the organism is saturated with this vitamin, the concentration in the blood varies between 14 and 18 mg. per litre and some passes in the urine. This corresponds to the utilization of 50 mg. of ascorbic acid in a 70-kilogram subject (0·7 mg. per kilo).

In predeficiency the figure may be 0·1 mg. per kilo, and the proportion in the blood 0 to 4 mg. per litre. The minimum should be 12 mg. per litre.

The numerical results obtained vary somewhat with the methods employed, but with a standard procedure useful information is obtainable in regard to the existence or not of vitamin-C deficiency.

An indication of such deficiency may also be ascertained by examination of the urine.

The subject ingests 250 mg. of ascorbic acid per day and a daily analysis of the urine is carried out. If the reducing properties of the urine on 2 : 6 dichlorphenol-indophenol increase on the first day, then the body is saturated—the most satisfactory condition. It may, however, take one to five days, and if it takes longer than this definite predeficiency exists.

The test is satisfactory, but errors are liable to occur unless it is carried out under strictly scientific conditions owing to difficulties in connexion with the instability of ascorbic acid in urine even when it is acid, and with the presence of salts, urea, uric acid, etc.

An additional test recently introduced [6] and the subject of experiment is the intradermal injection of 0·01 c.c. of 2 : 6 dichlorphenol-indophenol under the epithelium of the forearm in an area free from hair and small superficial veins, since the latter may cause confusion as they are the same colour as the dye.

The times of injection and complete disappearance of the dye are noted. In order to minimize any error which may arise in the size of the wheal, *four* wheals are raised and the average time for decolorization is taken in each patient.

In a group of some thirty-five cases subjected to this test it was found that on the average 16·9 minutes were required for decolorization in cases unsaturated with the vitamin, 7·5 minutes in cases partially saturated, and 2·3 minutes in those fully saturated. Reducing the matter to simple terms it may be assumed that a decolorization time of less than five minutes indicates tissue saturation with vitamin C, and of ten minutes or longer a deficiency in this vitamin.

This test, it will be realized, is not difficult of application in bulk examinations, and should further investigations confirm its accuracy, it is likely that it will prove to be of extreme value to us in the determination of latent deficiencies of vitamin C.

Turning now to a consideration of vitamin A apart from the well-known effects of deficiencies in this vitamin, typified by diminished resistance to disease and the like, certain abnormal conditions of the eyes may occur, such as keratomalacia and xerophthalmia. The former is common in ill-nourished human beings, children being specially prone to suffer,

while the latter or "dry eye" is less serious and is particularly common in children in Southern India.

Of special moment in the assessment of vitamin-A deficiencies is hemeralopia or "night blindness."

This is characterized by an inability to see in any but a good light due to lack of power in the eye to form sufficiently quickly the visual purple which is essential in the adaptation of the eye to dim conditions of light [7]. The cause of this is lack of vitamin A.

In order to carry out tests in this connexion it is necessary to ascertain quantitatively the minimum intensity of light in which visual acuity can be determined by some particular ophthalmological test, first when the eye has been moderately dazzled beforehand by a given source of light and secondly after a certain time has been allowed to elapse for adaptation to complete darkness.

Edmund's [8] and the Birch and Hirschfield's photometer methods are probably the most satisfactory means of carrying out this test.

In order to estimate latent deficiencies in vitamin D X-ray examination of the wrist has been employed, but the method does not give as early an indication of these as the determination of phosphatase in the blood. An increase in this enzyme occurs in the blood in the presence of bone and certain other diseases, and is not specific for rickets.

The sign is, however, of practical importance in children suffering from incipient rickets, but otherwise clinically normal, and it appears before the clinical, radiographic, and other biochemical indications in the blood.

In the normal child of 1 to 10 years it is stated [10] that phosphatase varies from 100 to 250 units. In rickety children between 6 months and 2 years it is 300 to 700 units.

As regards vitamin B there is a definite relationship between dietetic intake and urinary output [11] in the individual, and measurement of the B content of the urine is consequently of value in the estimation of the extent of B deficiency if any in the diet. Harris and Leong state that a daily excretion of less than 12 international units in the urine is indicative of a dietary deficiency of this nature.

Methods of estimation of B in the urine are being investigated by various workers. Of these the most important from our point of view appears to be

> a chemical test which depends on the fact that the vitamin can be easily oxidized to thiochrome which possesses a strong fluorescence. The degree of fluorescence produced varies with the amount of the vitamin present [12].

This completes a consideration of those specific physiological tests which it is suggested are the most important of those that have emerged

from investigations carried out up to the present by various workers, and we will now turn to those of a non-specific type.

These are to all intents and purposes equivalent to tests of physical efficiency, and it will be agreed that trials of this nature should be included in any series of tests having as their object the assessment of nutrition.

The dynamometer test is one of strength and of the functional efficiency of the voluntary neuromuscular system.

The pulling power of the child is measured and the results of the $\frac{\text{P(ull)}}{\text{W(eight)}}$ ratio are compared.

A number of investigations are being carried out with this method of assessment of physical efficiency and with a modification of the test in which the time in seconds the child can keep the dynamometer at a figure equal to half the maximum pull is recorded.

The hanging bar test is an index of physical endurance and consists merely in ascertaining the number of seconds for which a child can remain hanging on a horizontal bar.

Although the last two tests mentioned cannot be looked upon as infallible guides to nutrition, yet they may be employed, within reason, as pointers in one direction or the other.

Finally, Romberg's test is popular with some observers and is a measure of equilibrium and muscular co-ordination.

The child is made to stand at attention with eyes closed, and instability and discomfort are watched for for some fifteen to twenty minutes. It is stated that most unfit children break down in ten minutes.

The various methods, mentioned above, having for their object the detection and estimation of nutrition, are of a direct nature and involve examination of the individual of various descriptions.

It should be pointed out, however, that indirect means of investigation exist of which the most important is that of the dietary survey. This is of particular value when applied to communities, institutions, and the like, and if properly carried out will indicate shortage of protective foods, etc., in the diet.

It will not discover malnutrition in the individual but will assess the corporate liability to it of a community as far as dietetic causes are concerned.

Certain quantitative dietary surveys of this kind have been and are being made under the ægis of the Advisory Committee on Nutrition, and valuable information is likely to be forthcoming. The family budgetary aspect of the question is also being considered in these investigations.

Finally, the beneficial effects of extra milk on school children and others, whose diets otherwise have sufficient energy value, afford sure evidence of prior malnutrition in those in whom these results are observed.

Considering now the question of the prevalence in this country of malnutrition, some light is thrown on the matter by the reports of school medical officers, in which the findings as regards the incidence of malnutrition, as assessed by the clinical method, are given.

Summarizing these findings: In 1,696,527 school children assessed as regards their nutrition in 1937:—

15	per cent	were	classified	as	excellent.
73·8	,,	,,	,,	,,	normal.
10·6	,,	,,	,,	,,	slightly subnormal.
0·6	,,	,,	,,	,,	bad.

These findings were very similar to those of previous years and it may be assumed that some 11 per cent of school children in this country on the average are below the normal in nutrition.

In certain districts though, such as the Special Areas, the figures are very different, and in 1935, in Jarrow, some 22·9 per cent and 6·7 per cent of school children were slightly subnormal and markedly subnormal respectively.

In Pontypridd the figures were 19·75 per cent and 4·76 per cent.

Additional evidence is available from the recruiting figures which testify to the large proportion of those men offering themselves for enlistment who are below the comparatively low standards of physique required. In 1935 it is stated some 62 per cent were rejected, and there is still a comparatively large medical rejection rate. It seems reasonable to assume that an examination of the poorer classes would disclose a similar if not more adverse state of affairs.

The evidence of our own eyes when we glance at the large numbers of obviously substandard individuals who crowd the pavements of our towns and cities is incontrovertible, and this lack of physical fitness is in a majority of cases due not to frank disease but to malnutrition. This may have been induced in numerous cases by defective feeding, but such factors as overwork, lack of sleep and recreation, insufficient fresh air and so on have an important bearing on the matter, and must not be forgotten —nor must we lose sight of these "other factors" in forming our opinions as to what preventive measures should be undertaken.

In the Political and Economic Planning Report on the Health of the Nation it is mentioned that Spence and Friend compared children of the middle and working classes in Newcastle and found that of the latter some 47 per cent were below average height and some 55·2 per cent below average weight. In the middle class children 25 per cent were over the average height and 48·4 per cent above the average weight.

It is interesting in this connexion to note that the boys at the Duke of York's School, Dover, and Queen Victoria School, Dunblane, are on entry below the average for their class; and it would appear that it

is some two years before they attain this average as the result of good feeding and environment. Subsequently they achieve even higher standards, but never reach, as far as average measurements are concerned, those of the public schoolboy.

From observations of Christ's Hospital schoolboys emerged the interesting fact that at 13 years of age they are on the average 2·4 inches taller than the Council schoolboys, and at 17 years 3·8 inches taller than employed males. Although environmental and hereditary factors play a part there is evidence to show that diet is a most important element in the situation.

For instance in a well-known experiment at an Industrial School, boys fed on an "adequate" diet grew at the rate of 1·84 inches a year, whereas those on extra milk as well grew 2·6 inches a year.

An experiment in Scotland showed a 20 per cent increase in weight in 1,500 school children given additional milk compared with children not so treated.

Sir John Orr came to the conclusion that about half of the population of the United Kingdom have a diet deficient in vitamins A and C, and that a similar proportion of the people do not obtain sufficient quantities of phosphorus and iron.

Professor A. L. Bowley criticized these findings on various grounds but states "there is abundant medical evidence that malnutrition slight or serious is widespread and that there are classes of the population here and abroad whose unaided resources are too small for adequate expenditure on food."

In conclusion, it may be accepted that while ideas may differ as to the extent to which malnutrition is prevalent in this country, a consensus of opinion considers that it is an adverse factor in the health of the nation which affects its people to a material degree.

The subject is one which is of peculiar interest to those in the Service in its special relation to the health of children and others in tropical and semi-tropical climates.

Unfortunately statistics are not available at present which throw any great light on the matter, but in many cases the experience of those to whose lot it has fallen to be responsible for the supervision of the health of families in India and other countries undoubtedly is that malnutrition is prevalent among them to a considerably greater degree than is the case in this country. It would seem also the reasons for this are to be found mainly in dietary defects of which lack of vitamins is probably the chief, coupled with adverse climatic conditions.

It will be agreed that this subject of malnutrition in military families at home and abroad is one which is deserving of our special study as Army medical officers and that we should play our part with the civilian medical

services in eliminating as far as we can malnourishment in the child and in helping to build up the national health.

It will be realized also that a wide field of investigation into the matter is open to us.

In the prevention of malnutrition it is clear that the importance of doing all that is possible to increase milk consumption, particularly in children, is paramount.

Under the milk-in-schools scheme, in which Army school children in this country participate, one-third of a pint of milk at the cost of ½d. is available for the ordinary child but for malnourished children free milk is obtainable.

It is estimated that about half of the 7,000,000 school children in this country between the ages of 5 and 18 years are taking milk in school, and in England and Wales in the year ending March 31, 1937, 22,750,000 gallons were consumed in this connexion. It will, however, be agreed that though one-third of a pint a day for a child is better than none at all, much benefit from this amount cannot be expected unless the home as distinct from school consumption of milk of the individual child is greater than is usually the case, and that the amount per head authorized in schools at present at the cheap rate should be increased.

Schemes for increasing the milk consumption by the industrial population of our factories also exist and at the end of 1937 covered more than 5,000 factories containing 1½ million work-people who consumed about 600,000 gallons a month.

The installation of milk bars is being encouraged and these are increasing in numbers, though they do not in all probability account for more than about 4,000,000 gallons a year.

In many areas too, facilities exist for the provision of milk for nursing mothers and young children from welfare centres.

These and other schemes are doing much to augment the drinking of milk, and the necessity for this is indicated by the conclusion come to by the Advisory Committee on Nutrition that the national consumption of milk including that of the dried and condensed type is only some 60 per cent of what is considered necessary by the Technical Commission of the League of Nations Health Committee.

In other directions and from the dietetic point of view, much is being done.

Arrangements exist in a majority of areas for the provision of school meals, which in necessitous cases are free. In a number of areas three meals a day are available both during term and in the holidays. In other cases midday meals or "milk" meals are provided while some Local Authorities supply cod-liver oil and malt extract.

Propaganda and instruction are of the greatest moment, and it is

impossible to emphasize unduly the importance of adequate instruction in nutrition and cookery in schools, and of propaganda work in maternity and child welfare centres and the like.

The Central Council for Health Education and the National Milk Publicity Council do valuable work in this connexion, while the British Medical Association with the publication of "Family Meals and Catering" has done much to help. It should be mentioned, moreover, that those interested in this matter may obtain advice and assistance from either of the two national councils referred to.

Finally, it has already been stressed that dietetic factors are not the only consideration in the production of malnutrition and consequently in its causation other possible factors in the situation must be considered.

Their ascertainment may involve careful inquiry in each case into environment at home, at school, or at work, as the case may be, and the taking of all practicable steps to rectify any conditions found which are reacting adversely on the health of the individual. Space, however, does not allow of further consideration of factors of the nature referred to, which may include within their scope circumstances adverse to the individual of many and varied descriptions.

In conclusion the writer would mention that his article is intended primarily to stress the need for further investigation and is little more than a summary of the important points which arise in connexion with this much discussed subject of nutrition. He would invite the attention of those interested to certain reports and publications the majority of which are included in the references given below.

In particular a study of the *Bulletin* of the Health Organization of the League of Nations, Volume VI, No. 2 of April, 1937, which contains a report on the work of a group of experts appointed to study methods of assessing the state of nutrition in infants and adolescents, and of the section of the recent P.E.P. (Political and Economic Planning) Report on the Health Services of the Nation which deals with nutrition, will afford more detailed enlightenment to those who are interested in this important question.

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MECHANIZATION AND THE MODERN FIELD AMBULANCE.

By Lieutenant-Colonel J. C. A. DOWSE, M.C.,
Royal Army Medical Corps.

When putting forward these ideas of what a field medical unit might look like in the future, I realized that it was easier for the Ancients to change a law of the Medes and Persians than it is to effect an alteration in the War establishments in our own times.

There are so many permutations and commutations in any change that one hesitates to suggest that alterations should be attempted. Whilst this is the case, it strikes the outside observer that very marked and radical alterations have been made in the War Establishments of other branches of the Service, in order that these arms might be able to compete with the different type of work that they have to perform in what the experts consider the most probable form of warfare in which our Army will have to take part when the next crisis descends upon us.

The changes in the fighting units have been so revolutionary, particularly as regards their transport, that one cannot but wonder whether the changes in the medical units have kept pace with those in the other branches of the Army.

It is with these thoughts in one's mind that this article is written, in the hope that when a time comes to revise the War Establishments it may be found that alterations are possible so that the field medical units may have a greater chance adequately to perform their duties than would appear possible with the present formation.

Causes for an Alteration in our Organization.

The fighting units are all taking to wheels or tracks, many of them at any rate are being carried for a large portion of the distance that they must travel before they meet with the enemy. (I can, however, still see the winner of the next war marching to victory in the old ammunition boot should the horse and mule really be so moribund as they appear to be in the Army.)

The field medical units must of necessity take to wheels in a like manner; further, EVERY MAN must have a seat in some kind of vehicle if efficiency is to be maintained. I am certain that this statement is essential to the formation of a useful field medical unit.

When a division moves into action in open warfare it is absolutely essential that the field ambulances should be able to move from point to point as complete units with that division.

The WHOLE of a field ambulance is required for work, immediately, with the attacking troops, even if some part of the division may be following by line of march or is being embussed.

At present forty-eight of the small personnel of a field ambulance cannot be seated in the vehicles of the unit.

A field ambulance commander will be very seriously handicapped if he has to wait for even a small portion of his personnel to arrive by bus or on foot after the forward troops are in contact with the enemy. The suggestion that the field ambulance three-ton lorries can be sent back to collect the remainder of the personnel is not a practicable proposition; during the absence of these lorries the unit becomes completely immobile, and in any case, as things stand at the moment, would have to dump the water trailers that the lorries draw. The alternative suggestion that extra transport should be obtained when required is equally unsound as this transport will be necessary AT ALL TIMES; it is not likely that the bus companies will be able to ear-mark buses for this purpose as a permanent arrangement.

Our regulations state that "a field ambulance is essentially a mobile unit."

The watchword of the fighting forces is being embodied in the term MOBILITY, the advanced medical units *must* be equally mobile.

Duties of a Field Medical Unit.

If the foregoing be accepted as reasonable premises for our argument, let us now consider the duties to be performed by a field medical unit.

I can see no change from the accepted principles, namely, "TO COLLECT the sick and wounded and to arrange for their proper disposal." I have put the word collect in capitals as that seems to me to be the important and, at the same time, the difficult part of our duty. The principles of collection and disposal of wounded have not altered through the ages, but the method must move with the times.

During the first stage in the presumptive modern war, the area over which we may expect to get casualties will be very much larger than in static warfare. The distances that wounded will have to be carried will be vast and quite beyond the capabilities of the two-legged stretcher bearer.

The line of evacuation from the R.A.P. via the A.D.S. to the M.D.S. may be anything from six to twenty miles. This combined with the constantly changing front will place a great strain on the resources of the Field Ambulance Commander to find a method of keeping in touch with his advanced posts and will almost certainly cause a breakdown in the medical arrangements. The present design of the field ambulance is most unsuitable for this type of work and the number of motor ambulance cars hopelessly inadequate in the forward area.

In order, therefore, that we may be able to adhere to our principles of clearing the battlefield and evacuating the casualties, it would seem to me that the old stereotyped method of moving the sick and wounded from the R.A.P. to the A.D.S., thence to the M.D.S. *en route* to the C.C.S. will have to go.

The cumbersome, over-equipped field ambulance will have to be modified and, in my opinion, modified to such an extent as to be scarcely recognized as such. Possibly the name might be changed to a "Field Evacuating Unit." This can only be done by remembering that the main duty of a field ambulance is to evacuate the casualties as rapidly and as comfortably as possible. A field ambulance is really performing its duty properly when it is empty.

My vision of the field ambulance of the future is a unit with the minimum of equipment and the maximum number of machines capable of carrying a wounded man. These may be either light, well-sprung motor ambulances and/or motor cycle stretcher carriers, driven by R.A.M.C. personnel, trained as drivers as the personnel in mechanized units are already trained. (Of this more anon.)

Our surgeons tell us that 99 per cent of wounded should be brought to them in the shortest possible time after the receipt of their wound, irrespective of the length (within limits) of the journey in the ambulance car. Why, therefore, delay the arrival of the wounded by admitting them to a main dressing station where little surgery can be or, in fact, is done, instead of evacuating them direct to the casualty clearing centre of a forward operating centre.

Results of Evacuating Direct to the C.C.S.

If the main dressing station is done away with, a large portion of the present field ambulance equipment can be done away with in the same way, thereby reducing the number of vehicles and increasing the mobility of the forward medical units.

The General Staff, whilst insisting on the mobility of the fighting forces, is greatly exercised by the constant demand for more and more vehicles to carry the personnel and equipment. This may partially explain the fact that the present field ambulance cannot move as a complete unit on wheels. Many vehicles are filled with equipment, which, I submit, would not be required if the organization of the divisional medical units is modified on the lines that I am about to suggest.

It is obvious that if you do away with a central place from which casualties are collected, i.e. the M.D.S. AND INCREASE THE DISTANCE THAT MOTOR AMBULANCE CARS MUST TRAVEL TO DELIVER THEIR LOAD OF WOUNDED, you must at the same time INCREASE THE NUMBER OF MOTOR AMBULANCES WORKING CLOSE TO THE LINE so that the even flow of cases

may be maintained. Hence some of the cars of the M.A.C. will fuse into the forward evacuating unit as the M.D.S. will no longer require clearing.

This, at first sight, would seem to be defeating the very idea by which we are attempting to make the forward medical units more mobile and effect a reduction of the number of vehicles with the division. However, a reduction of the number of "non-essential" vehicles will have taken place by modifying the organization of the field ambulance, but from the nature of the work to be done there must be an increase in the number of "essential" vehicles, namely motor ambulance cars.

It is not likely, apart from exceptional circumstances, that all the motor ambulance cars will be required at the same time in the forward areas, so that a pool of cars can be held in reserve when the main body of the Division moves forward, therefore reducing the congestion in the more advanced areas of the front, in much the same way as the present M.A.C. is kept some distance behind the Division with which it operates until its services are required.

The A.D.S. will remain as the point or points from which casualties are collected and evacuated direct to the C.C.S. or Rest Station.

The amount of attention received in the forward area will be the minimum to ensure reasonably safe arrival at the C.C.S. with the minimum of distress to the patient.

Elaborate splintings and dressings will not be done; the surgeons tell us that much valuable time is wasted at the M.D.S. by attempting too extensive dressings, etc., all of which have to be re-done when the patient arrives at the C.C.S.

The C.C.S., from the nature of the work that it has to perform, is a unit that must remain in one position for a long time and cannot move rapidly from one place to another. When, therefore, the M.D.S. is short-circuited, a modification of the C.C.S. becomes necessary.

The C.C.S. proper can remain much the same unit as heretofore but a new unit must come into being or the light section of the C.C.S. must take on the duties of this unit. A forward operating centre or centres must be formed. One can see the C.C.S. anything from 50 to 100 miles behind the forward troops, too far to send the fractured femurs, etc.; the forward operating centre must be well up behind the battle front so that the surgeon can get his cases in good time. This situation appears to arise even now under our present organization and will have to be met should a war start in the near future.

Certain problems undoubtedly present themselves with regard to the reports and returns that are required by Division, 2nd Echelon and other formations, but it is quite easy to arrange that these returns are rendered to the correct department by the medical unit that finally receives the casualty. An increased clerical staff can be given to the C.C.S., or

Divisions can detach some of the field ambulance clerks to see that the necessary states are properly maintained.

Still keeping in mind the necessity of mobility in the forward medical units, some of the functions of a field ambulance during the late war, namely the formation of divisional rest stations and gas centres, would have to cease to be part of the responsibility of the divisional units.

Rest stations are still required for the reception and care of sick and wounded casualties that may be expected to be fit to return to their units in, say, one week's time. These rest stations could be modelled on the organization of the headquarters of a field ambulance and be capable of dealing with three or four hundred minor cases; they would be just behind, but not in or of the Division that they serve, semi-permanent in nature; they would not move when the Division in front of them moves, unless and until the whole force advances a considerable distance. In other words, the rest station would be a non-divisional unit administered by the D.M.S. of the Army or D.D.M.S. of the Corps.

In the same way gas centres would have to be formed as a branch of the C.C.S., or a rest station be specially equipped to deal with this type of case.

During the last war, when a Division left for another part of the line the field ambulance which was open as a rest station had to hand over to the incoming field ambulance, leaving its casualties behind and then catch up with its own Division. In the same way the M.D.S. had to be handed over, thus limiting the mobility of the outgoing units, a factor that is assuming more and more importance in the light of modern mobility. If there is no M.D.S. and the rest station is a permanent non-divisional fixture this handing over and taking over becomes unnecessary. The field medical units will be highly mobile, having evacuated their casualties to the C.C.S. or rest station nearest to their front.

THE ORGANIZATION OF THE MODERN FIELD AMBULANCE.

The old Cavalry Field Ambulance and its modern counterpart is on the road to becoming the ideal evacuating unit. In the past the M.D.S. of that unit really served as an A.D.S. from whence cases were sent direct to the C.C.S. or to the M.D.S. of the field ambulance in rear of the cavalry.

As constituted at present this mobile field ambulance falls far short of the ideal by reason of the fact that the sections are undermanned and lacking in motor ambulance cars. If these could be increased by the addition of light ambulance cars and motor cycle stretcher carriers together with extra R.A.M.C. bearers its efficiency would at once improve.

Once the idea is established that a field ambulance is to cease to carry equipment capable of giving elaborate medical attention to anything

from 150 to 2,500 patients in twenty-four hours, part of the problem of efficiency and mobility will have been solved.

It would seem to me that there is no necessity to make any distinction between the types of the future field ambulance (or evacuating unit) as a unit organized on the lines to be suggested would be equally at home whether working with a "cavalry" division or an infantry formation.

What then might the future field medical unit look like?

I can see a central headquarters which will correspond to the present-day field ambulance headquarters.

Here will be the officer commanding the divisional field medical unit. He will have enough equipment to set up a unit capable of rendering first aid to say 200 cases in an emergency, his staff might include three medical officers, a dental officer and a quartermaster with sixty other ranks R.A.M.C. It might be necessary to have a portion of the personnel of the transport wing of the M.A.C., mainly the repair section. The personnel would, of course, also include the R.A.S.C. drivers until such a time as the driving can be done by the personnel of the R.A.M.C.

The remainder of the unit would consist of three companies forming the forward evacuating or bearer companies. Each company would have a Major and four Captains or Lieutenants with 150 other ranks.

Each one of these companies will be able to form an A.D.S. The feature of the bearer company will be that they are very heavily equipped with motor ambulance cars of the light type, capable of carrying two stretcher cases, together with motor cycle stretcher carriers. Each company will be capable of dealing with the casualties of one Brigade. Being highly mobile they will be able to move over a wide area and collect casualties from an extended front by means of their motor vehicles.

The evacuation of the casualties will be direct to the C.C.S., Forward Operating Centre, Rest Station or Gas Centre as circumstances may direct. Casualties collected by the light cars from the outlying areas can be transferred to the heavier vehicles at the A.D.S.

The unit, therefore, has per division a headquarters and three companies. The motor ambulance transport of this unit would consist of the following cars :—

With headquarters: 20 heavy cars. With each company: 5 heavy cars, 10 light cars, 10 motor cycle stretcher carriers or an additional 10 light cars. This gives a total of 95 motor ambulance vehicles for the Division.

When the type of work that has to be done is taken into consideration this number will not prove to be excessive. In addition, the fact that the M.A.C. has been absorbed into the actual divisional unit must be realized.

If our wounded are to be properly looked after and collected in a reasonably short time after they have had the misfortune to be wounded,

the medical services must be given an organization that can do the work. Sometimes it would appear that the time that it takes an ambulance car to collect a wounded man, transport the case for (say) ten miles, and then return to pick up the next load, is not fully realized. It is therefore essential that the number of the vehicles at the disposal of the medical units should be such that there is a chance of living up to the ideal of rapid evacuation of casualties. If this cannot be done then the standard expected of the medical services must be revised and allowances made for their inability to perform their allotted task in war.

The motor cycle stretcher carrier mentioned above is a controversial type of vehicle. The French have found that a wounded man was reasonably comfortable on a well-designed cycle carrier, and the mobility of these machines even over very poor country is well known. One of our officers has already written on this subject; the idea, as far as I know, has never been developed in this country, but it seems to come into the realm of practical usefulness.

The light motor ambulance requires a chassis engined by a motor of not less than 18 to 20 h.p. giving a high power to weight ratio, with a light body. The wheels should be sprung independently, the centre of gravity low, but with plenty of ground clearance. The ambulance car should carry two stretcher cases or the equivalent number of sitting cases.

The Results of the Altered Organization.

The main result will be increased mobility of the forward medical units brought about by the fact that the equipment of the suggested unit can be cut down by practically all the material that is now required to equip and run a main dressing station in two of the three present-day field ambulances. It is desirable that the headquarters of the unit should have the necessary medical equipment mentioned previously in this article.

There would, therefore, be a reduction of a considerable quantity of transport now required to carry equipment which could, perhaps, be employed in carrying the personnel. The organization of the companies will need to be of such a nature as to ensure that they can be self-contained when separated from their headquarters for any length of time, but in the normal course of events they would be rationed and administered from the headquarters of the unit.

The increase in the number of motor ambulance cars actually with the division will naturally have its repercussion in the other corps such as the R.A.S.C. and R.A.O.C., etc.

Finally the suggested modification in the field medical units would result in a unit so constituted that it would be of a universal type, equally effective with "cavalry" or infantry formations, bringing with the change simplification in maintenance of both equipment and personnel.

In the event of a brigade being detached on separate duty very little modification of the medical personnel would be required. The headquarters of a field ambulance might accompany the brigade with one company, possibly overloading the equipment side, but as the brigade might not be supplied with the necessary units behind it, such as rest station and gas centre, when on this detached duty, the extra personnel and equipment of the headquarters would supply this deficiency.

Method of Collecting and Dealing with Casualties.

This problem seems to divide itself into two parts: first, the collection of casualties in open and moving front warfare; second, the arrangements for static or stationary warfare.

The first phase of the modern war may well be one of tremendous movement.

Two alternatives seem to me to stand out in regard to the Medical Services.

One means that with our present organization of the field medical units we must leave our casualties to their fate, in the hope that, sooner or later, we shall be able to evacuate them to the C.C.S. Casualties will be spread over a big area, but with the best intentions in the world the regimental medical officer can do no more than give his cases first aid, group them in some convenient place for collection, and then notify the field ambulance of the location of these groups. It will then be the responsibility of the field ambulance commander to collect and evacuate them. For this purpose he requires motor transport. The present allotment of ambulance cars will only permit him to collect from one or two points on his widely-spread front; the remaining "dumps" of wounded will have to wait till he can get to them, possibly after many hours delay.

On the other hand, if we organize ourselves on the lines suggested by establishing a much larger number of car-collecting posts and with our increased number of ambulance cars we can get the cases back very much more quickly.

The light vehicles can be used in the more advanced areas, cases being brought back to the A.D.S. and there changed over to the heavier vehicles for final disposal.

The main principle being the formation of numerous collecting posts on the line of advance, gradually converging towards the rear of the divisional front.

It is hard to foretell how long this first phase of movement will last, but sooner or later the fighting will become more stationary in character.

The work of the medical units will then lose many of its problems,

but the new organization will work equally well. The system of collecting posts will still function, the light motor vehicles will be as useful as ever: the Ford ambulance cars gave plenty of evidence of this fact in France and elsewhere. The A.D.S. might be a little further behind the line than was customary in France, so that the large cars could come to take the cases collected by the bearer company from the R.A.P.s and deposited at the A.D.S. by the light vehicles.

The advanced operating centre, rest stations and gas centres manned by non-divisional R.A.M.C. personnel would, of course, function in the same way as when the fighting was of the mobile type.

Suggestions on Personnel.

During the last war the shortage of medical officers for the forces in the field was giving the authorities considerable anxiety. There was a movement to supply the lack of officers for the forward field units by replacing them by selected N.C.O.s of the R.A.M.C. and promoting these N.C.O.s to commissioned rank. The intention was that the new grade of R.A.M.C. officer should be employed in the field ambulances as "bearer officers" and be in charge of the evacuation of the forward areas. This scheme appears to have a great deal to recommend it in war time. There is no doubt that every regiment requires a qualified medical man as its regimental medical officer, if for no other reason than to maintain the morale of the officers and men of the regiment, but there is reason to doubt that it requires a registered medical practitioner to perform the duties of a bearer officer in a field ambulance.

Our senior N.C.O.s have all the medical knowledge required to render first aid to the wounded and at the same time would make very excellent bearer officers, thereby releasing a doctor to make use of his knowledge where his experience is more definitely required.

When making the suggestion that our ambulance cars might be driven by our own personnel, I realize that the differences between the peace organization of the R.A.M.C. and the war time units of the Corps are so marked that such a suggestion seems to be rather optimistic, but in this mechanical age the number of youths who have some kind of experience in the actual driving of motor vehicles or can acquire that knowledge in a very short space of time is very large. Is it altogether too fantastic to imagine that we might be able to give some of our peace-time recruits enough preliminary training to make them become reasonably good drivers, so that they can be ear-marked for that type of duty in war?

Conclusion.

These notes are written in no sense of carping criticism. It is realized that they are open to the attack that the suggestions put forward depart

too greatly from the accepted standards. However, the standards that enabled us to be such an efficient service during the Great War, twenty years ago, will not serve us now any more than the standards that helped Wellington to win at Waterloo would enable our present commander-in-chief to win the next war, even though the main principles are the same.

I am very grateful to Lieutenant-Colonel W. E. Tyndall, M.C., R.A.M.C., for his help in straightening out some of the all-too-rough corners of this article. His candid criticism has helped me a great deal.

I would also like to thank Major-General F. D. G. Howell, C.B., D.S.O., M.C., K.H.S., D.D.M.S., Aldershot Command, for permission to send this article for publication.

SUPERCHLORINATION OF WATER IN THE FIELD—EFFECT ON CERCARIÆ.

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SUPERCHLORINATION of water under field conditions has been tried out both at home and in Egypt with considerable success. Briefly, the method employed is to do a Horrocks test and read the result in half an hour. Then, if "x" equals the number of scoopfuls of water-sterilizing powder indicated by the test, "x" plus one scoopful is added to each 100 gallons of the water to be sterilized. After 15 minutes contact enough sodium thiosulphate is added to neutralize one scoopful of the water-sterilizing powder and the water is then ready for use.

During 1938, it was decided to try a series of tests to determine what dose of water-sterilizing powder it was necessary to add to the dose indicated by the test to ensure death of cercariæ in 15 minutes from the time of contact.

The essential criteria were:—

(1) To use the Horrocks test, as it controls the strength of the water-sterilizing powder.
(2) To adhere to the 15 minutes contact as speed is important.
(3) Evidence of death of the cercariæ to be taken as *cessation of any movement* when observed under the low power of the microscope.

Planorbis and Bullinus snails infected with *S. mansonii* and *S. hæmatobium* were used. In order to get a good mixed "brew" the cercariæ from about a dozen infected snails were used on each occasion.

The infected snails, placed in a small glass funnel, were washed with tap water for about five minutes before being used.

It was at first decided to carry out these experiments under field conditions, but it was soon realized that this would be too cumbersome.

The following simple routine was then adopted. The Horrocks test was set up and the solution of water-sterilizing powder added to each of the white cups in the usual manner. 9 c.c. of the mixture in each white cup was transferred to small glass containers numbered to correspond with the white cups of the test and called the "containers."

Each container was immediately inoculated with 1 c.c. of water from the glass vessel containing fresh cercariæ and a control was set up.

The containers were examined under the low power of a binocular microscope, equivalent to ⅓ inch lens on the ordinary microscope.

At the termination of half-an-hour the test was completed and the reading noted.

It was therefore possible to ascertain the relation between the Horrocks test and the containers in which the cercariæ were dead and, as these containers corresponded similarly with the numbered cups, with the cups concerned.

The water-sterilizing powder used throughout these tests was manufactured by Imperial Chemical Industries.

Series I.—Tests carried out during July, 1938.
Water-sterilizing powder containing 25 per cent available chlorine and dated February 25, 1937.

No.	Source of water	Temperature of water in degrees C.	pH value	Horrocks test No. of Cup	No. of container containing dead cercariæ in 15 minutes
1	Tap	(b)	—	1	2
2	Nile unfiltered ..	(b)	—	2	3
3	Irrigation unfiltered	(b)	—	3	3
4	Tank unfiltered ..	(b)	—	6	Nil (a)
5	Tank unfiltered ..	(b)	—	6	7
6	Tank unfiltered ..	(b)	—	6	7
7	Tap	27·5	—	2	2
8	Tank unfiltered ..	27·5	8·7 to 9·0	5	6
9	Nile unfiltered ..	27·5	8·0 to 8·3	3	3

Notes.—(*a*) Horrocks tests set up in Cups 1 to 6 only.
(*b*) Water temperature not recorded but was between 25° and 28° C.

From the above it would appear that when using water-sterilizing powder with a chlorine content of 25 per cent the dose necessary to kill human cercariæ in 15 minutes when the temperature is moderately warm is that indicated by the Horrocks test plus one scoopful per 100 gallons.

In order to ascertain if similar results were obtainable during the flood period of the Nile, it was decided to repeat these tests later in the year. Unfortunately there was a very high flood and it was not possible to obtain any infected snails until almost the end of November. Planorbis snails infected with *S. mansonii* were used throughout these tests.

To determine the relation of cold to the lethal action of water-sterilizing powder on cercariæ, the water used in some of these tests was cooled in a refrigerator to 5° C. All receptacles which were used were cooled, as was the beaker containing the live cercariæ.

After inoculation the containers were immediately replaced in the refrigerator. The temperature of the water in the Horrocks cups was taken and is the temperature recorded. The cups were also replaced in the refrigerator and allowed to remain there until the half-hour contact was up.

The containers were removed from the refrigerator in 15 minutes, quickly examined, replaced and removed again in half-an-hour for final

examination. Otherwise the routine detailed for the first series of tests was carried out.

The following results were obtained :—

SERIES II.—TESTS CARRIED OUT DURING NOVEMBER AND DECEMBER, 1938.

The water-sterilizing powder used was dated February 28, 1937, and contained 23·85 per cent available chlorine.

No.	Source of water	Temperature in degrees C.	pH value	Horrocks test No. of Cup	No. of container containing cercariæ *dead* in	
					15 min.	30 min.
1	Tap	19·0	—	1	6 (*f*)	(*d*)
2	Tap	19·0	—	1	2	(*d*)
3	Tap	19·0	—	1	3	(*d*)
4	Tank unfiltered ..	—	—	4 or less (*g*)	7	(*d*)
5	Tank unfiltered ..	20·0	7·9	3	5	(*d*)
6	Tank unfiltered ..	20·0	—	3	5	3
7	Tank filtered	18·5	7·9	2	3	2
8	Tank filtered	18·5	7·9	2	2	2
9	Tank filtered	18·5	7·9	2	2	2
10	Tank rough filtered ..	18·5	—	2	3	2
11	Nile filtered	17·5	—	2	Nil (*a*)	Nil (*a*)
12	Nile filtered	17·5	—	2	Nil (*b*)	4
13	Nile filtered	17·5	—	2	Nil (*b*)	3
14	Nile unfiltered	16·0	—	2	3	3
15	Nile unfiltered	16·0	—	2	4	3
16	Nile unfiltered	16·0	—	2	3	3
17	Tap	19·0	7·5	1	4	2
18	Tank filtered	17·0	8·0	2	Nil (*a*)	(*d*)
19	Tank filtered	17·0	8·0	2	3	2
20	Nile filtered	15·0	7·8	2	Nil (*a*)	3
21	Nile filtered	15·0	7·8	2	4	3
22	Nile unfiltered	16·0	—	2	5	3
23	Nile unfiltered	16·0	—	2	4	3
24	Nile filtered	16·0	7·9	2	4	3
25	Nile filtered	16·0	7·9	2	4	3
26	Nile filtered	16·0	7·9	2	4	(*d*)
27	Nile filtered	6·0	7·8	2	Nil (*c*)	2
28	Nile filtered	8·0	7·8	2	6	4 (*e*)
29	Tank filtered	7·5	7·7	1	5	2
30	Tank filtered	8·0	7·7	1	5	4 (*h*)

NOTES.—(*a*) Nos. 1, 2 and 3 containers only.
(*b*) Nos. 1, 2, 3 and 4 containers only.
(*c*) Nos. 1, 2, 3, 4 and 5 containers only.
(*d*) Not done.
(*e*) Nos. 4, 5, 6 and 7 containers only.
(*f*) Nos. 2, 3 and 4—dead. One dying in No. 5.
(*g*) Horrocks test set up in Nos. 4 to 9 only.
(*h*) Nos. 4, 5 and 6 containers only.

From the above it will be observed that the Horrocks test bears no relation to the container in which cercariæ were found dead in 15 minutes, but a definite relation exists to those in which the cercariæ were dead in 30 minutes, viz., the test dose or the test dose plus one. In only two tests were live cercariæ found in a container corresponding to test dose plus more than one after half-an-hour's contact (Nos. 11 and 12). These tests were immediately repeated and the cercariæ were found dead in 30 minutes in Horrocks plus one.

Several variants appear to affect the recorded rate of death of cercariæ when acted upon by chlorine. Among these are :—

(a) *The criterion of death of the cercariæ.* In these trials it was stipulated that absolute cessation of movement indicated death. Other workers have pointed out that cercariæ are harmless when they are found creeping or partly swimming at the bottom of the receptacle after exposure to chlorine. There seems little doubt that this is so, but, as the "creeping or partly swimming" movement is one which involves a different standard with each worker, a standard was adopted in which there was less likelihood of human error.

(b) *Temperature.* It would appear that as the temperature falls the lethal action of chlorine on the cercariæ is slower. These tests ranged between 27·5° and 6° C. At the former temperature it was found that the Horrocks dose plus one was always sufficient to kill cercariæ in 15 minutes, while at 6° C. Horrocks dose plus four was required. It was not possible to test the lethal action of chlorine at temperatures at or below freezing point.

(c) *The age of the cercariæ.* Absolutely fresh cercariæ, say less than one hour old, are more resistant to chlorine than those which are older. In all these tests absolutely fresh cercariæ were used.

(d) *The pH value of the water.* Generally speaking, the higher the pH value the slower the action of the chlorine on cercariæ, but this was not fully investigated.

(e) *The amount of foreign matter in the water.* The cup indicated by the Horrocks test always contains a residual chlorine in excess of 1 p.p.m. after the half-hour contact. Owing to this the amount of chlorine absorbed does not show up in the tests recorded. Several tests were carried out with unfiltered water. It was realized that filtration of water in the field was not always perfect and it was therefore determined to carry out these tests under all conditions that might be encountered.

In the strengths used no striking results were noticed as regards "shock" action of chlorine on cercariæ.

From the above variants, and there may be more, it will be seen that different workers can easily get widely divergent results when working at different times of the year, or with different waters, etc. Much has been written about these results, one writer even suggesting that the cercariæ used were not pathogenic schistosomes. There is little doubt about the pathogenicity of the schistosomes used. The apparent contradictory results are due to differences in the variants mentioned above, and the results of the different workers would appear to be correct using their own particular variants as standards for their results.

It was desired to discover the value of "x" in the formula H plus "x" = dead cercariæ in 15 minutes. It was found that "x" varied from 0 to 4 and it is considered that if "x" has to be fixed it will be somewhere in the vicinity of H plus 6 but even this is not certain. *It was found, however, that when using water-sterilizing powder containing* 23·85 *per cent chlorine and working in a range of temperatures between* 27·5° *and* 6° *C. the dose indicated by the Horrocks test plus one was lethal to cercariæ in* 30 *minutes or less*, and that these tests bore a definite relation to one another.

All these tests were carried out in a laboratory where thorough mixing was ensured of the water-sterilizing powder solution and the water which was being tested.

Until a more perfect mixing device is fitted to Army water trucks it is felt that some margin must be left in the dose for possible error or human frailty. It is therefore recommended that, if the contact period of half-an-hour is accepted, the dose to be used in the field when working with fresh water-sterilizing powder should be that indicated by the Horrocks test plus two.

Thanks are due to Professor Mohamed Khalil Abdel Khalek Bey, M.D., Ph.D., M.R.C.P., D.P.H., D.T.M.&H., Director of the Research Institutes, Egypt, for his valuable advice and for giving permission for this work to be carried out in the Research Laboratories; to Ali Hassan, M.Sc., Ph.D.Liverpool, my co-worker, without whose help it would have been extremely difficult to carry out these tests; and to all the Laboratory Staff who so whole-heartedly gave their assistance.

"PUNCH DRUNK."

By Lieutenant-Colonel G. W. WILL, O.B.E.,
Royal Army Medical Corps.

This is a condition to which attention has lately been paid in both the medical and the lay press. It has long been recognized that a boxer, while still on his feet in the ring, may, through repeated blows on the head, be brought to a state closely resembling alcoholic intoxication. Such a man appears dazed, his resistance to his opponent is more or less automatic and there may be amnesia for part or all of the contest. This confused state may also follow a single "knock out" blow where there has been a period of unconsciousness, but it may also follow a series of blows none of which has been severe enough to produce unconsciousness. The term "punch drunk" appears to have been applied originally to this confused condition in the ring or to a similar state persisting for a short time after. It is now realized that this state may be more persistent and, in some cases, permanent, if not progressive.

In a "knock-out" it is obvious that there has been a cerebral concussion. Trotter describes cerebral concussion as "an essentially transient state due to head injury which is of instantaneous onset, manifests widespread symptoms of a purely paralytic kind, does not as such comprise any evidence of a structural cerebral injury and is always followed by amnesia for the actual moment of the accident." This describes most cases of "knock-out" where contact with "the point" has been secured and the force of the blow transmitted to the contents of the cranium through the condyles of the jaw. The force may be considerable and it is surprising that so little permanent damage appears to be done by it. In this typical case we may conclude that there has been a pure concussion with no structural damage to the brain substance. In cases where symptoms persist or arise subsequently we are dealing with a cerebral contusion with damage to the brain substance. Here we find, amongst other pathological lesions, multiple punctate hæmorrhages. To this condition the term "traumatic encephalitis" is applied. It is obvious that in a very severe cerebral contusion there may be extensive damage. The term "punch drunk" is limited to those cases in which the lesion is extra-pyramidal. It is well known that the extent of bony injury is no guide to the damage that may have been done to the brain by an injury to the head. It is possible, indeed, that a fracture may minimize the effect on the brain by diminishing intra-cranial pressure by allowing leakage of fluid. An X-ray report of "no bony injury" is of no help in aiding one to estimate the effects of a previous head injury.

I recently attended a course at the Maudesley Hospital where this subject was discussed by Drs. Guttman and Mayer Gross. They consider that in these cases of "punch drunk" we are dealing with a traumatic encephalitis where the lesion is extra-pyramidal (pyramidal lesions would furnish quite a different syndrome). The main clinical sign is a marked inco-ordination. Dr. Guttman summarized the symptoms as follows: Equilibrium is most usually and severely affected. Speech tends to be slurred. The patient has a vacant look in the eye. There is impairment of intelligence to a varying degree. The mental condition varies from a suspicious paranoid state to aggressive boastfulness. Dr. Guttman described two cases, one of which began like an acute chorea and progressed to a Parkinsonian state. In the second the diagnosis lay between hysteria and an extra-pyramidal lesion. He emphasized the very important fact that in extra-pyramidal lesions the patient is very easily influenced by emotion and that, therefore, he may be much worse when directly observed. This may raise suspicions of hysteria and so tend to obscure the diagnosis.

The strict definition of hysteria is: "The representation or exaggeration of some incapacity (whether physical or mental) motivated by desire to obtain pleasure or reduce displeasure with incomplete knowledge of the motive or intention for representation or exaggeration. If knowledge is complete then the condition is malingering: if such insight is totally and permanently lacking then we are dealing with a psychotic condition which should hardly be called hysteria" [2].

I have recently seen two suggestive cases. The first was under observation for a few days only and no accurate history could be obtained. The main symptom appeared to have been recurring attacks of "nightmare," some of which were accompanied by impulsive acts of violence. He was a boxer of no mean repute. When seen by me he appeared to have recovered from his nightmares and was on his way to England. It was found that he had distinct Rombergism and difficulty with the finger-nose test. His mental attitude was one of cheerful nonchalance.

The other case was interesting and unusual. Lack of space insists upon a mere epitome. He was a boxer of no mean calibre, a beautifully-muscled man in the pink of condition, an Army-in-India semi-finalist beaten on points and said that he had never been knocked out. This was subsequently confirmed. He was admitted to hospital because he started having "fits." The first occurred while he was on guard. These fits were provoked by loud or unexpected noises and were always the same in character. They began with violent and dramatic clonic contractions during which he threw himself about violently, finishing up in a position of opisthotonos and then passing into a state of tonus in which all his skeletal muscles were firmly contracted. There was no loss of consciousness and the tonus persisted until obliging attendants massaged it out.

On the morning of his admission to the Neurological Section at Colaba he had fourteen of these "fits" within four hours. The more interest shown in his case the more dramatic became the display, but the fits were also provoked by attempts to drink or to take food. The favourite stimulus was a sudden noise such as banging a door or scraping a chair on the floor. He was difficult to examine and the only definite neurological sign that could be elicited was a marked plantar extensor reflex on the right side. The following conditions were considered: (1) strychnine poisoning, (2) tetanus, (3) pseudo-rabies, (4) chorea, (5) epilepsy, (6) hysteria, (7) simulation, and later, (8) punch drunk. The exclusion of the first four was simple—they are mentioned to give an idea of the apparent severity of the condition—while the character of the fits excluded epilepsy, either ideopathic or Jacksonian. It was concluded that the condition must be mainly hysterical. He was kept under continuous narcotisation by dilaudid and scopolamine for three days, being allowed to come round morning and evening for attention to bowels and bladder and for nourishment which contained a high proportion of glucose. This resulted in marked improvment and then suggestion therapy was started. Within another three days his fits had stopped and he was behaving almost normally.

It was then found that the extensor plantar reflex persisted on the right side, the left was doubtful. There was inco-ordination, most marked in the finger-nose test, there was also distinct dysdiodochokinesis and also marked Rombergism. His mental attitude was one of arrogant boastfulness, and he, little realising that his letters were censored, took great pride in writing to his friends and telling them how much trouble he had caused. It was noticed that unexpected noises occasionally produced an attack of trembling but the attendants paying no attention this quickly passed off. He remained in this state until transferred to England a month later. I do not yet know his subsequent history. All laboratory examinations were negative and there was no increase in the pressure of the cerebrospinal fluid. X-ray examination of the skull showed nothing abnormal.

Deliberate stimulation seemed unlikely as no reason for this could be discovered and it would not account for the organic signs. Pure hysteria seems equally difficult to accept unless his failure to secure an expected win in the All-India semi-finals had something to do with it. Unfortunately, a full psychological examination was not possible. The diagnosis "punch drunk" or traumatic encephalitis seems reasonable enough in view of his remaining symptoms—disorder of co-ordination and equilibrium, marked loss of emotional control, hysterical manifestations and his mental attitude, which was one of arrogant boastfulness. It was made purely tentatively and it is hoped that a "follow-up" of his case may appear

later. The persistence of a plantar extensor reflex on the right side suggests more than a pure extra-pyramidal lesion.

In Army boxing circles there seems to be a tendency to make light of the effects of a "knock-out" or head injury received during a contest. In calling attention to possible dangers attendant upon the practice of the noble art of self-defence I am treading on delicate ground. However, the condition of "punch drunk" is an important one from more than one point of view. In Army boxing, with the contests limited to three rounds, with capable referees, and with men trained to box rather than to fight, it is probably not found nearly so frequently as in the professionals' training camp. That it does occur is well known to boxing fans and it surprises me that they tend to regard it so lightly. The condition is well worth bearing in mind when dealing with obscure cases of "hysteria" associated with inco-ordination.

It may not be out of place in this connection to recall attention to the danger of the combination of head injury plus tropical sun plus alcohol—a combination that is almost certain to produce instability, if not disaster. I have often heard it remarked that the patient is all right because "the X-ray shows no bony injury." This is a delusion. In many cases of quite severe injury to the brain there has been no bony injury. It has always been my policy to recommend a change to England for such cases as severe concussion following riding accidents. If the concussion has been a severe one, that is with a prolonged period of unconsciousness and persistent after-symptoms, it may be assumed that there has been cerebral contusion as well. Until recovery takes place there are two things to avoid—the sun and alcohol. The patient may avoid the latter and his medical adviser should help to avoid the former. An injury in the boxing ring may produce just as severe after-effects as a fall hunting or at polo, and I see no reason for discriminating between the two classes of case. In each, a conservative line of treatment is indicated, especially in a tropical country. This applies particularly in India, where, until recently, the established social customs did not encourage abstinence from alcohol. A saner outlook on the use of this highly toxic source of energy is happily gaining ground. This, however, as Kipling said, is another story.

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Editorial.

REPORT OF THE FOOD INVESTIGATION BOARD FOR THE YEAR 1937.

THIS Report of some 261 pages is submitted to the Lords of the Committee of the Privy Council for Scientific and Industrial Research by the Chairman of the Food Investigation Board, Professor Sir Joseph Barcroft, who succeeded Sir Frank Smith during the year.

There is a general statement of the work being carried out by the Board written by Professor Barcroft, then follows the Report of the Director of Food Investigation containing an introduction and eight sections, each written by the workers on a particular subject. Section I deals with meat; Section II with poultry and eggs; Section III with pork, bacon and hams; Section IV with fish; Section V with fruit; Section VI with vegetables; Section VII with canning; Section VIII with engineering problems.

The Chairman writes that "from time to time we are asked whether food that has been stored by modern methods, such as cold-storage, gas-storage and canning, is as nutritious as fresh food." The Board not being competent to answer the question consulted the Medical Research Council. The Council replied that it is impossible to state categorically whether or not stored foods are as nutritious as fresh foods. Many years of intensive work on large groups of human beings would be entailed and even then, in view of the prospect of further knowledge of the effects of dietary factors on nutritional processes, it might be found that the results of the first few years' studies would have to be reconsidered in the light of fresh evidence. "Nevertheless, useful information can be obtained by comparing the chemical composition of stored foods with that of fresh foods and the general conclusion can be accepted that relatively little loss of known constituents occurs in foods stored by modern methods. Moreover, experiments have been carried out on animals in which satisfactory nutrition has been maintained with diets composed solely of stored foods. The available evidence suggests that modern methods of storing foods cause little depreciation in their nutritive value; in fact it may be said that food of good initial quality that has been stored by the best modern methods is likely to be superior in many respects to similar food that, though still technically fresh, is in reality stale.

"One substance of important biological significance, especially associated with fresh fruit and vegetables, namely vitamin C, or ascorbic acid, is well

known to be easily destroyed by heat, applied in ordinary cooking or canning; to a less extent, vitamin B_1 is liable to be similarly affected."

Two important pieces of work have been undertaken for the Herring Industry Board. The first deals with the quality of kippers in relation to the quality of the fresh herrings from which they are made. The second deals with the freezing and cold storage of herrings. The development of rancidity in the fat of herrings during cold storage is due to the action of certain enzymes and experimental evidence suggests that these enzymes are activated by common salt. Herrings that have been frozen in brine need careful washing and glazing before they are stored, and it would be a great advantage if freezing could be done in air so that contact with brine could be avoided. This possibility is now being explored by the Herring Industry Board.

There has been a great improvement in the way in which fish are stored in ice on trawlers at sea, especially on long-distance trips. Storage in ice will keep fish fresh for ten to twelve days, a period which covers two-thirds of the trips made by British trawlers. Beyond this period bacteria are able to multiply at the temperature of melting ice and some more powerful method is required. A method has been worked out of freezing the fish in brine at a temperature of $-20°$ C. and storing them at the same temperature, or better at $-30°$ C. Treated in this way white fish retain their original freshness for six months; in fact lemon soles have been kept in a palatable condition for as long as two years. The fish should be frozen immediately after it is caught. The urgent need is for the freezing of that part of the trawler's catch that cannot be landed within twelve days. The industry is now seriously considering the commercial possibilities of brine freezing and cold storage.

The pH which muscle reaches in *rigor mortis* is determined in the main by the amount of glycogen it contains at death. The present practice of resting animals for twenty-four hours after a fatiguing or exciting journey is essential, and they should be allowed a ration of easily absorbed food, such as cane-sugar or glucose. Struggling on the slaughtering floor should be reduced to a minimum. The liberation of lactic acid is very heavy during exertion of short duration and while the animal is still alive it passes into the circulation and is lost during the subsequent bleeding. The ideal method of slaughtering would appear to be electrical stunning of the quietly resting animal, thus avoiding all excitement and most of the struggling.

Some interesting results have been obtained concerning the fat-oxidizing enzyme of pork. This enzyme, which powerfully accelerates the production of oxidative rancidity even at temperatures below 0° C., has been shown to be present in the muscles and adipose tissue of the pig and also to some

extent in used tank pickle. In both fatty tissue and muscle juice increases in the activity of the enzyme have been observed on the addition of sodium chloride. The lipoxidas of the muscle juice is very active in acid solution. Above about pH 5·2 it falls off rapidly and at pH 7 it is very small and possibly absent. The activity of the enzyme is destroyed by exposure to 60° C. for five minutes.

The red colour of bacon, nitrosohæmoglobin, is due to the combination of the hæmoglobin from the muscle with the nitrite in the pickle. As a result of two years' research it is now possible to estimate the concentration of nitrite in the pickle and the period of curing which will give a satisfactory colour to bacon.

The type of rot in hen's eggs may be allocated to four groups. There are two types of black rot, red or pink rot, and green rot. These rots are the specific work of a small group of related organisms. In black rot, type I, the egg is dark and opaque over the lamp and the shell membranes are distended with gas. The yolk is hard, black and solid, the white entirely liquefied, turbid, and light brown or greenish brown in colour. The odour is fæcal. A complex microflora can be isolated from such eggs, but inoculation experiments indicate that organisms of the Proteus group by themselves reproduce the rotting. *Proteus melanovogenes*, isolated by Miles and Halman from black rot in South African eggs, has not been found in the Australian and New Zealand eggs studied here, and the black rot obtained with strains of Proteus isolated in England, antigenically unrelated to *Proteus melanovogenes*, is often softer, the yolk consisting of an outer "custard-like" layer with a black core. The second type of black rot exhibits a fluorescent or greenish-brown white with a soft greenish black yolk. The odour is often putrid, but frequently there is a strong "cabbage-water" smell.

Red or pink rots are characterized by coloured patches in the white, varying from golden-brown through rusty-red to deep blood-red. The yolk membrane is often opaque, the white may be entirely liquefied. The smell varies from "crayfish" to "cabbage-water." Organisms of the Pseudomonas group are in the main responsible for this type of rotting.

Green rot is the rot most frequently found in industry, and it is very insidious, as in its early stages it may escape detection over the lamp. The white is bright yellowish-green and fluorescent, the yolk unchanged in the early stages. Subsequently the membrane may become thick and opaque, and some blackening may be obtained. Green rot is due to infection of the white with species of Pseudomonas. Comparatively few species of Pseudomonas cause blackening, so that many of the green rots never become black.

Washing under clean conditions has little or no effect on immediate

penetration of bacteria already present on the shell, even with dirty eggs. Washing, however, renders bacterial penetration much easier when the washed egg is exposed to further bacterial infection. The more vigorous the washing the greater the effect. The quality of the egg is an important factor. Twenty-four hours soaking in a dense bacterial suspension failed to effect any bacterial entry into first-grade unwashed eggs, while twenty seconds soaking, on the other hand, with unwashed second quality eggs, gave such an infection that 13 per cent of the eggs rotted on incubation.

The study of the apple's respirations has brought to light a fact of great importance in the storage of this fruit. At the stage before they reach full maturity, at which they are often gathered, namely just before what is called the climacteric rise in respiration, apples exhibit on exposure to concentration of carbon dioxide up to 15 per cent a temporary increase in activity which may amount to 100 per cent. The practical bearing of this fact is that in all forms of cold storage, both on land and at sea, the possibility of carbon dioxide accumulating to a dangerous level is greater immediately after the fruit has been put into store, especially if it is warm and is on that account respiring freely, than had hitherto been thought possible. In gas storage in particular, where all possible precautions are taken against accidental leakage, the desirable concentration of carbon dioxide may be obtained more rapidly than had been anticipated, with a consequent risk of being overstepped.

The influence of environment and food upon the composition of the fat of fish has been studied on live eels, and the results show that environment has little influence when the intake of fat is low. A seasonal variation has been found and is correlated with the seasonal variation in the rate at which fat is ingested.

Work on the cold storage of lemon soles has shown that the enzyme causing rancidity is present chiefly in the lateral brown streak of muscle just beneath the skin. Endeavours are being made to obtain a dried preparation of the enzyme so that its characteristics may be studied under standard conditions.

The bacterial flora of salt-cured herring and their pickles differ from that of fresh herring; curing has a selective influence and species characteristic of curing salts are present. The higher the concentration of salt in the cure the more apparent is the ripening to a "cured" flavour, the smaller is the bacterial population (the fish may even be sterile after a few weeks) and the less is the bacterial spoilage. So far, however, the results do not exclude the possibility that bacterial action is a factor in the process of ripening.

Some interesting experiments have been made on the freezing and

cold storage of smoke-cured fish. There were two questions: First, which procedure yields the better result—smoking fish after cold storage or cold storing fish after smoking? Secondly, how far can the quality of exported smoked fish on arrival at its destination be improved by better cold storage without assuming any improvement in the condition of transport overseas?

In the case of white fish, smoking fish that has been cold stored gives a better product than first smoking the fish and then putting them in cold storage. The quality of fish treated in the latter way is, however, good, and if the temperature of storage is as low as −30° C. a cured fish suitable for the home market may be obtained after storage for periods up to five or six months.

As regards herrings, the experiments showed that a better kipper is ultimately got by smoking herrings after cold storage than by making kippers and then putting them into cold storage. The kipper after storage at −30° C. for four or five months remains suitable for the home market.

As regards transport, experiments show that smoked fish that have been stored for three months at −30° C. are still better after six weeks' storage at higher transport temperatures (−10° C. or −20° C.) than if storage had been carried out at these latter temperatures all the time. The deterioration of fish at −10° C., the common temperature of transport, is so great in six weeks that it is doubtful whether increased storage in this country of fish destined for export would be justified. The results point to the necessity of lowering the temperature of transport overseas, as well as of cold storage here, if a serious improvement in the quality of exported smoked fish is to be achieved.

Clinical and other Notes.

AN UNUSUAL CASE OF SUBARACHNOID HÆMORRHAGE.

By Captain R. J. G. MORRISON,
Royal Army Medical Corps.

This case is reported because of certain unusual features; an acute and fatal termination occurred on the thirty-fourth day after a bout of fever of eleven days' duration.

History.—A soldier, aged 23, was admitted to hospital on June 27, 1938.

He had previously been in good health, but two days prior to admission had complained of feeling listless and feverish. Some headache was present; it was described as a dull, continuous frontal ache, but general weakness was the main complaint. No other symptoms were present and the patient had not previously had any serious illness.

On Examination.—The patient looked ill. His temperature was 101·6° F., pulse 68. General physique good. The tongue was slightly furred. The teeth, gums and pharynx were normal. Some small lymphatic glands were felt in the left deep cervical region of the neck and in the right and left axillæ.

There was no abnormality detected in the heart and the blood-pressure was 120/84. At first slight impairment on percussion over the base of the left lung was suspected but this was not confirmed on subsequent examinations.

Progress.—The fever, for the greater part, was continuous, and subsided suddenly on the eleventh day of illness. The temperature was usually between 101° and 103° F. The pulse-rate was not markedly raised. The patient was on the whole very comfortable, but headache was present for the first three or four days. Repeated physical examinations were carried out but nothing was found to account for the fever. There was no neck rigidity and Kernig's sign was negative. Both tympanic membranes were normal and there was no tenderness on palpation or percussion of the cranial sinuses. The urine was normal on routine examination.

The patient was discharged on July 16 after the temperature had been normal for eight days. The table illustrates the investigations that were carried out during the patient's stay in hospital.

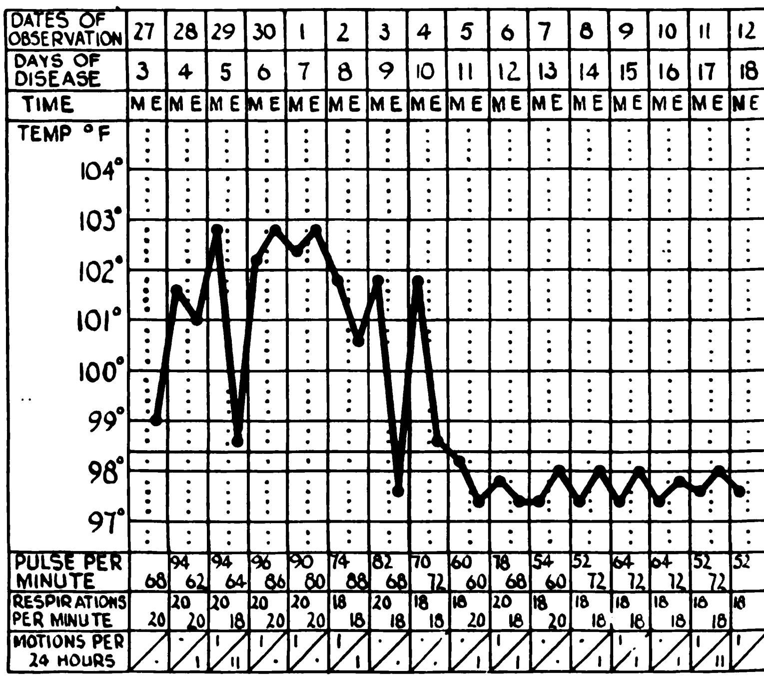
After discharge the patient felt fit and did not complain of headache or other symptoms. He was attending the regimental medical inspection

Blood for malaria parasites	Neg.	Neg.	Neg.								
W.B.C.			7,500 P. = 70, L = 26 LM = 2, E = 2		6,800			7,000			
Blood culture	Neg. to pathogenic organisms	Neg. to pathogenic organisms	Neg. to pathogenic organisms	Neg. to pathogenic organisms							
Serum agglutinations		T.A.B. TO, AO, BO OX 19, OX 2 OX K Neg.		T.A.B. TO, AO, BO OX 19, OX 2 OX K Neg.		T.A.B. TO, AO, BO OX 19 OX 2 OX K *B. abortus* *B. melitensis* Neg.					
Stools for E. H. and cysts	Neg.				Neg.		Neg.		Neg.	Neg.	Neg.
Stools for enteric group					Neg.				Neg.	Neg.	Neg.
Urine for enteric group				Neg.	Neg.		Neg.			Neg.	Neg.
X-ray chest				Neg.							
Day of disease	3	4	5	6	7	8	9	10	11	12	13

Abbreviation: Neg. = Negative.

room and was seen on several occasions by the medical officer who stated that the patient seemed quite well.

On August 12 it was reported that the patient was about to mount guard at 6 p.m. when he suddenly fell down in a "fit." Considerable forced movements were present which needed the efforts of two men to control. His temperature was 102° F. On examination shortly afterwards the patient was comatose and restless. Temperature 97° F., pulse 60. Pupils at first contracted and reacting to light. Breathing stertorous. Limbs flaccid. Tendon reflexes present. Cutaneous reflexes



absent. No neck rigidity. Kernig's sign negative. Plantar reflexes extensor on both sides. A catheter was passed but no urine could be obtained. Subarachnoid hæmorrhage was suspected and on lumbar puncture thick uniformly blood-stained cerebrospinal fluid, which appeared to be under considerable pressure, was withdrawn. The patient died in coma at 10 p.m.

Post-mortem.—The examination was confined to the skull and its contents. There was extensive subarachnoid hæmorrhage over the vertical region of both cerebral hemispheres, which were congested and œdematous on the surface.

There was extensive clotting and maceration of brain tissue in the interpeduncular space and around the circle of Willis. The vessels were firmly embedded in blood-clot, and though they were traced as far as

possible no aneurysm was detected. The hæmorrhage had extended into the left lateral ventricle, which was full of blood-clot, and also into the cisterna magna.

Discussion.—A congenital aneurysm of the circle of Willis is the commonest, if not the only source of subarachnoid hæmorrhage. It is thought likely that the period of fever was caused by a leakage from such an aneurysm. That a slow hæmorrhage can take place from one of these congenital aneurysms is a well-known fact, and the meningitic syndrome, the lumbago-sciatica syndrome, and the syndrome of recurring coma are well-established manifestations of this occurrence.

The mechanism of production of the fever must of course be a matter for conjecture, but the following facts are of interest.

The tuber cinereum lies in close relation to the branches of the circle of Willis, being surrounded by vessels on all sides. Wright (1937) states that experimental puncture of the tuber cinereum is attended by a rise of temperature and occasionally by glycosuria, and it is interesting to note that glycosuria is a common accompaniment of subarachnoid hæmorrhage. Brain and Strauss (1934) state that a disturbance of the tuber region is sometimes responsible for pyrexia and that fever not uncommonly follows operation upon craniopharyngeal pouch cysts. Moreover Jefferson (1932) has described pyrexia in patients with tumours of the tuber cinereum.

It may well be that the fever in this case was caused by the leakage of blood from an aneurysm producing an irritating effect upon the tuber. In conclusion, the case illustrates the fact that there is yet another condition to be added to the long list of causes of pyrexia of uncertain origin.

I am indebted to Colonel W. L. E. Fretz, late Officer Commanding, British Military Hospital, Lucknow, for permission to forward these notes for publication.

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SOME NOTES ON HOSPITAL EXPENDITURE.

By Colonel T. H. SCOTT, D.S.O., M.C.,

and

Lieutenant (Quartermaster) P. J. MARTIN,

Royal Army Medical Corps.

A system is in vogue at the Cambridge Hospital which considerably assists control over the transactions of the "spending" departments and the incidents of normal routine which involve expenditure of public money. The system has now been in operation for nearly three years, and having

proved most useful, it is hoped that it may be of some value to others concerned in hospital administration.

Briefly, the principle is that certain selected transactions in the Steward's Store, Linen Store and Dispensary are reviewed weekly. Items are changed as expenditure fluctuates and, based on the number and class of patient under treatment, the demands of individual wards and departments are scrutinized.

PRO-FORMA "A."

DIETS AND EXTRAS ISSUED FROM THE STEWARD'S STORE DURING THE WEEK ENDED FRIDAY ....

WARDS.	Diets. Ordinary.		"Other"						TOTAL "Other" Diets	EXTRAS.																Daily Average patients under treatment.
	Wards.	Dining Hall.	Chicken.	Fish.	T.B.	Milk.	Beef Tea.	No Diet.		Puddings. No	Custards. No.	Eggs. No.	Milk. Pts	Tea. Ozs.	Jellies. No.	Tinned Fruit. Tins	Butter. Lbs	Guinness. Bts.	Ale. Bts.	Stout. Bts.	Lemonade. Syph					
No																										
No																										
No.																										
No.																										
No.																										
No.																										
No.																										
Officers																										
Totals.																										

Total......... Total.........

Total all Diets = ...

Daily average patients in Hospital = ...

PRO-FORMA "B."

CHANGES OF LINEN DURING WEEK ENDED FRIDAY ....

Wards and Departments.	Towels hand. No.	Sheets. No.	Pillow Slips. No	Handkerchiefs. No.	Overalls. No	Shirts. No.	Socks. No	Ties. No.	Counterpanes. No.													Total of Pieces.	Daily Average patients under treatment in Wards.
No.																							
No.																							
No.																							
No.																							
Operating Theatre																							
Casualty Theatre																							
TOTALS.																							

Daily average patients in Hospital :—

Cost of washing above :— £ s. d.

PRO-FORMA "C."

ISSUES OF DRESSINGS AND DRUGS FROM THE DISPENSARY DURING THE WEEK ENDED FRIDAY ....

Wards, Departments, Reception Stations, Medical Inspection Rooms, etc.	Gauze Pk	Wool. C.A. lb	Wool. N.A. lb	Lint. lb	Bandages Ass'd. No	* Crepe. No.	*Triangular No.	*Elastoplast. No.	Iodine. Ozs	Lysol. Ozs	Hyd'n Perox. Ozs	Meth. Spirit. Pts	Turpentine. Ozs													Daily average patients under treatment in Wards.
TOTALS.																										

Daily average patients in Hospital :—

PRO-FORMA "D."

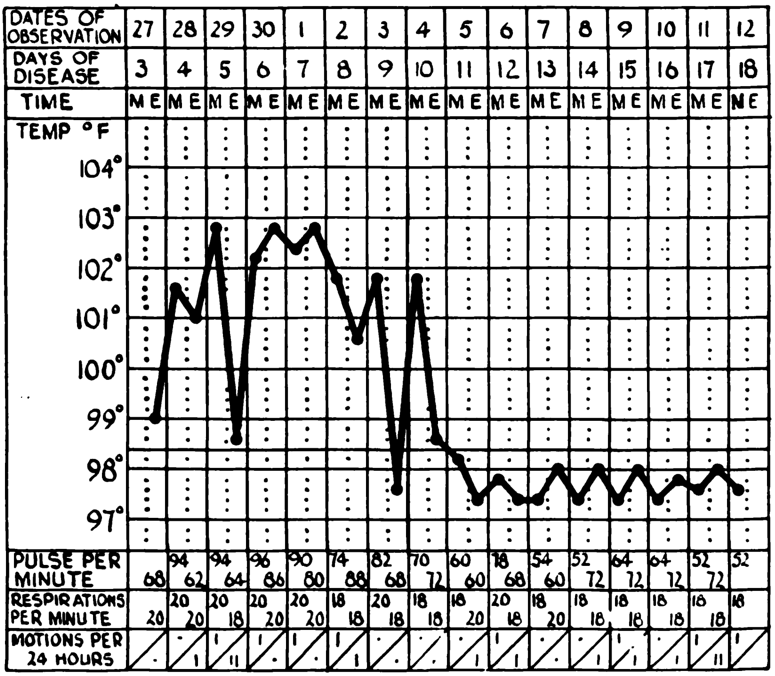
BREAKAGES OF CROCKERY CHARGEABLE TO THE PUBLIC DURING MONTH ENDED FRIDAY ....

Article	Cost per article.	Ward No. Weeks					Ward No. Weeks.					Ward No. Weeks.					Ward No. Weeks.					Ward No. Weeks.					Ward No. Weeks.					Ward No. Weeks					Total articles for month	Total cost for month
		1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5		
TOTALS.																																						

		£	s.	d.
Cost	1st Week			
	2nd Week			
	3rd Week			
	4th Week			
	5th Week			
	Total			

room and was seen on several occasions by the medical officer who stated that the patient seemed quite well.

On August 12 it was reported that the patient was about to mount guard at 6 p.m. when he suddenly fell down in a "fit." Considerable forced movements were present which needed the efforts of two men to control. His temperature was 102° F. On examination shortly afterwards the patient was comatose and restless. Temperature 97° F., pulse 60. Pupils at first contracted and reacting to light. Breathing stertorous. Limbs flaccid. Tendon reflexes present. Cutaneous reflexes



absent. No neck rigidity. Kernig's sign negative. Plantar reflexes extensor on both sides. A catheter was passed but no urine could be obtained. Subarachnoid hæmorrhage was suspected and on lumbar puncture thick uniformly blood-stained cerebrospinal fluid, which appeared to be under considerable pressure, was withdrawn. The patient died in coma at 10 p.m.

Post-mortem.—The examination was confined to the skull and its contents. There was extensive subarachnoid hæmorrhage over the vertical region of both cerebral hemispheres, which were congested and œdematous on the surface.

There was extensive clotting and maceration of brain tissue in the interpeduncular space and around the circle of Willis. The vessels were firmly embedded in blood-clot, and though they were traced as far as

possible no aneurysm was detected. The hæmorrhage had extended into the left lateral ventricle, which was full of blood-clot, and also into the cisterna magna.

Discussion.—A congenital aneurysm of the circle of Willis is the commonest, if not the only source of subarachnoid hæmorrhage. It is thought likely that the period of fever was caused by a leakage from such an aneurysm. That a slow hæmorrhage can take place from one of these congenital aneurysms is a well-known fact, and the meningitic syndrome, the lumbago-sciatica syndrome, and the syndrome of recurring coma are well-established manifestations of this occurrence.

The mechanism of production of the fever must of course be a matter for conjecture, but the following facts are of interest.

The tuber cinereum lies in close relation to the branches of the circle of Willis, being surrounded by vessels on all sides. Wright (1937) states that experimental puncture of the tuber cinereum is attended by a rise of temperature and occasionally by glycosuria, and it is interesting to note that glycosuria is a common accompaniment of subarachnoid hæmorrhage. Brain and Strauss (1934) state that a disturbance of the tuber region is sometimes responsible for pyrexia and that fever not uncommonly follows operation upon craniopharyngeal pouch cysts. Moreover Jefferson (1932) has described pyrexia in patients with tumours of the tuber cinereum.

It may well be that the fever in this case was caused by the leakage of blood from an aneurysm producing an irritating effect upon the tuber. In conclusion, the case illustrates the fact that there is yet another condition to be added to the long list of causes of pyrexia of uncertain origin.

I am indebted to Colonel W. L. E. Fretz, late Officer Commanding, British Military Hospital, Lucknow, for permission to forward these notes for publication.

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SOME NOTES ON HOSPITAL EXPENDITURE.

BY COLONEL T. H. SCOTT, D.S.O., M.C.,
AND
LIEUTENANT (QUARTERMASTER) P. J. MARTIN,
Royal Army Medical Corps.

A SYSTEM is in vogue at the Cambridge Hospital which considerably assists control over the transactions of the "spending" departments and the incidents of normal routine which involve expenditure of public money. The system has now been in operation for nearly three years, and having

proved most useful, it is hoped that it may be of some value to others concerned in hospital administration.

Briefly, the principle is that certain selected transactions in the Steward's Store, Linen Store and Dispensary are reviewed weekly. Items are changed as expenditure fluctuates and, based on the number and class of patient under treatment, the demands of individual wards and departments are scrutinized.

PRO-FORMA "A."

DIETS AND EXTRAS ISSUED FROM THE STEWARD'S STORE DURING THE WEEK ENDED FRIDAY ....

WARDS.	Diets. Ordinary.		"Other"						TOTAL "Other" Diets			EXTRAS.														Daily Average patients under treatment.
	Wards.	Dining Hall.	Chicken.	Fish.	T.B.	Milk.	Beef Tea.	No Diets		Puddings. No	Custards. No.	Eggs. No.	Milk. Pts	Tea. Ozs	Jellies. No	Tinned Fruit. Tins	Butter. Lbs	Guinness. Bts	Ale. Bts.	Stout. Bts	Lemonade. Syph					
No																										
No																										
No.																										
No.																										
No.																										
No.																										
No.																										
Officers																										
Totals.																										

Total......... Total.........

Total all Diets = ...

Daily average patients in Hospital = ...

PRO-FORMA "B."

CHANGES OF LINEN DURING WEEK ENDED FRIDAY ....

Wards and Departments.	Towels hand. No.	Sheets. No.	Pillow Slips. No	Handkerchiefs No.	Overalls. No	Shirts. No.	Socks. No	Ties. No.	Counterpanes No.													Total of Pieces.	Daily Average patients under treatment in Wards.
No.																							
No.																							
No.																							
No.																							
Operating Theatre																							
Casualty Theatre																							
TOTALS.																							

Daily average patients in Hospital :—

Cost of washing above :— £ s. d.

PRO-FORMA "C."

ISSUES OF DRESSINGS AND DRUGS FROM THE DISPENSARY DURING THE WEEK ENDED FRIDAY ....

Wards, Departments, Reception Stations, Medical Inspection Rooms, etc.	Gauze	Wool, C.A.	Wool, M.A.	Lint.	Bandages Ass'd	* Crepe.	*Triangular	*Elastoplast.	Iodine.	Lysol.	Hyd'n Perox.	Meth. Spirit.	Turpentine.													Daily average patients under treatment in Wards.
	Pk	lb	lb	lb	No.	No.	No.	No.	Ozs	Ozs	Ozs	Pts	Ozs													
TOTALS.																										

Daily average patients in Hospital :—

PRO-FORMA "D."

BREAKAGES OF CROCKERY CHARGEABLE TO THE PUBLIC DURING MONTH ENDED FRIDAY ....

Article	Cost per article.	Ward No. Weeks					Ward No. Weeks					Ward No. Weeks					Ward No. Weeks					Ward No. Weeks					Ward No. Weeks					Ward No. Weeks					Total articles for month	Total cost for month
		1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5		
TOTALS.																																						

		£ s. d.
Cost	1st Week	
	2nd Week	
	3rd Week	
	4th Week	
	5th Week	
	Total	

The necessity for any seemingly high expenditure is gone into at once, and an explanation sought from the individual responsible.

The transactions are noted in Army Books 124, ruled as shown in pro-formas A, B, C and D, regarding which the accompanying points may be of interest.

A.—STEWARD'S STORE.

The object of this form is to control the more expensive forms of diet and the issue of extras.

The table is drawn up to show the total diets issued and the "extras"

PRO-FORMA "E."

CAMBRIDGE HOSPITAL, ALDERSHOT.

Statement showing expenditure of certain selected extras during the period ....to ....

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
WARD	TOTAL DIETS other than Ordinary	PUDDINGS No. Cost ea.	CUSTARDS No. Cost ea.	EGGS No. Cost ea.	MILK Pints Cost per pint	TEA lbs. Cost per lb.	JELLIES No. Cost ea.	TINNED FRUIT Tins Cost per tin	BUTTER lbs. Cost per lb.			GUINNESS Bottles Cost per Bot.	ALE Bottles Cost per Bot.	STOUT Bottles Cost per Bot.	LEMONADE [illegible] Cost per [illegible]		TOTAL COST	[illegible] PATIENTS
		No. / Cost s. d.	No. / Cost s. d.	No. / Cost s. d.	Pints / Cost s. d.	lbs. / Cost s. d.	No. / Cost s. d.	Tins / Cost s. d.	lbs. / Cost s. d.			Bots. / Cost s. d.	Bots. / Cost s. d.	Bots. / Cost s. d.	[illegible] / Cost s. d.		£ s. d.	
								MEDICAL	DIVISION									
1 & 13																		
2 & 12																		
3 & 10																		
18 20 &																		
31																		
19 & 29																		
								SURGICAL	DIVISION									
4 & 30																		
8 & 9																		
7																		
6																		
21 26 [illegible]																		
23																		
TOTAL ALL WARDS																		

NOTE—This statement refers to certain selected extras only. It does not apply to any item of diet authorized by Allowance Regulations or the hospital menus as part of the diet.

demanded by wards over and above the ingredients allowed for diets by Allowance Regulations.

It will be noted that "Ordinary" diets are subdivided to show numbers in Dining Hall and Wards.

As regards Officers' Wards, the table shows only the "extras" demanded by the Sister in charge. Other commodities supplied to the kitchen for the menu of the day are dealt with separately.

B.—Linen Store.

This pro-forma is to control laundry charges.

C.—Dispensary.

There are items in the dispensary of a large hospital which are not "on charge," and this control has been found particularly useful as regards wool, lint and bandages.

It will be noted that the form provides for issues to other hospitals, medical inspection rooms, welfare centres, etc., which, although not affecting the "costs" of the issuing hospital, account for a very great deal of the expenditure from the dispensary.

PRO-FORMA "F."

Cambridge Hospital, Aldershot.

Statement showing number of certain selected articles sent to the laundry during the period

.... to ....

1 Ward / Cost of Washing	2 Daily Average Number of Patients	3 Towels Hand per doz.		4 Sheets per doz.		5 Pillow Slips per doz.		6 Handkerchiefs per doz.		7 Overalls per doz.		8 Shirts per doz.		9 Socks per doz.		10 Ties per doz.		11 Counterpanes per doz.		12 per doz.		13 per doz.		14 per doz.		15 per doz.		16 per doz.		17 per doz.		18 Total Cost			19 Cost per Average of 20 Patients		
		No.	Cost s. d.	No.	Cost s. d.	No.	Cost s. d.	No.	Cost s. d.	No.	Cost s. d.	No.	Cost s. d.	No.	Cost s. d.	No.	Cost s. d.	No.	Cost s. d.	No.	Cost s. d.	No.	Cost s. d.	No.	Cost s. d.	No.	Cost s. d.	No.	Cost s. d.	No.	Cost s. d.	£	s.	d.	£	s.	d.
MEDICAL DIVISION																																					
1 & 13																																					
2 & 12																																					
3 & 10																																					
16, 20 & 21																																					
18 & 29																																					
SURGICAL DIVISION																																					
5 & 30																																					
4 & 9																																					
7																																					
8																																					
[illegible]																																					
25																																					
TOTAL [illegible]																																					

D.—Breakages of Crockery and Glass.

This is an item of expenditure which calls for strict control.

Having the above information readily tabulated by weeks, it is published monthly throughout the hospital in the form of a cash statement, which in the case of dietary, laundry, drugs and dressings, is averaged on the cost each ward would incur were it continuously treating twenty patients daily.

To arrive at this detail, pro-formæ E, F and G are compiled for office use and record, and the information is published in simplified form on the lines of pro-formæ H and J.

PRO-FORMA "G."

CAMBRIDGE HOSPITAL, ALDERSHOT,

Statement showing quantities of dressings, etc., demanded by wards during the period

.... to ....

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
WARD	Daily Average Number of Patients	GAUZE Packets (Cost per 10 pkts.)	WOOL C.A. lbs (Cost per lb.)	WOOL N.A. lbs (Cost per lb.)	LINT lbs (Cost per lb.)	BANDAGES Assorted No. (Av. Cost per 100)	BANDAGES Crepe No. (Cost ea.)	BANDAGES Triangular No. (Cost ea.)	BANDAGES Elastoplast No. (Cost ea.)	IODINE ozs (Cost per lb.)	LYSOL ozs (Cost per pt.)	HYDROGEN PEROXIDE ozs (Cost per lb.)	METH SPIRIT Pints (Cost per pt.)	TURPENTINE ozs (Cost per lb.)			TOTAL COST	[illegible] PATIENTS
		Pkts. / Cost s. d.	lbs. / Cost s. d.	lbs. / Cost s. d.	lbs. / Cost s. d.	No. / Cost s. d.	No. / Cost s. d.	No. / Cost s. d.	No. / Cost s. d.	ozs. / Cost s. d.	ozs. / Cost s. d.	ozs. / Cost s. d.	Pts. / Cost s. d.	ozs. / Cost s. d.			£ s. d.	£ s. d.
									MEDICAL DIVISION									
1 & 13																		
2 & 12																		
3 & 10																		
16, 30 & 31																		
18 & 20																		
									SURGICAL DIVISION									
8 & 29																		
4 & 9																		
7																		
6																		
11, 26, Off.																		
21																		
TOTAL ALL WARDS																		

PRO-FORMA "H."

CAMBRIDGE HOSPITAL, ALDERSHOT.

Cost per 20 patients in respect of certain selected items during the 28 or 35-day period

ended ....

WARDS. No.	EXTRAS. This period.	Average of comparable periods of 1937.	LAUNDRY. This period.	Average of comparable periods of 1937	DRESSINGS. This period.	Average of comparable periods of 1937.
	£ s d.	£ s d.	£ s d.	£ s d.	£ s d.	£ s d.
			AVERAGE BY DIVISIONS.			
Medical.						
Surgical.						
			AVERAGE FOR HOSPITAL.			

PRO-FORMA "J."

BREAKAGES OF CROCKERY CHARGED TO THE PUBLIC DURING THE MONTH OF ....

ITEM.	COST.	Ward No :-												

COST PER WARD.

	£	s.	d.
Ward No.			
,, No.			
,, No.			
,, No.			
,, No.			
,, No.			
,, No.			
,, No.			
,, No.			
Total cost £			

PRO-FORMA "K."

ISSUES OF DRESSINGS, ETC., TO MEDICAL INSPECTION ROOMS DURING THE MONTH OF ....

Medical Inspection Room.	Gauze Pts	Wool C.A. lb	Lint. lb	Bandages L... No	" Trian'... No	" Elastc... No.	Iodine. Oz	Meth. Spirit Pts	Hyd. Perox. Ozs	Lysol. Ozs.	Pins. safety No.										Average number daily under treatment during month.

All Medical Officers, Sisters and others concerned in expenditure are thus shown in money values the result of their demands, and this has created a competitive spirit throughout the hospital, which is one of the objects of the scheme.

It has been found useful to adopt a similar system for medical inspection rooms. This is shown in pro-forma K.

The Control of Gas and Water.

The hospital allowance of each having been worked out to a daily proportion, and a record maintained of the meter readings taken each morning (and in the case of gas, at noon and 4 p.m. in addition), no difficulty is experienced in control under this heading.

An objection to the system outlined above may be the additional work it entails. In practice, and with proper co-ordination, no difficulty has been experienced in this respect at the Cambridge Hospital.

In conclusion, it is stressed that the system is not an "economy ramp." It is just an endeavour to secure a form of definite control over hospital expenditure, and to strike at extravagance and waste as soon as they occur, in preference to taking delayed action on the receipt of a monthly or quarterly balance sheet.

Travel.

KENYA.

By Lieutenant-Colonel F. S. GILLESPIE,
Royal Army Medical Corps.

(*Continued from page* 352).

February 26: We arrived at Nimule about 11 a.m. having seen a fine herd of buffalo and a solitary giraffe, who was escorted by a herd of water buck; he was evidently a local celebrity and we were told he had got across the river somehow a few years before and just wandered about with his water buck friends.

We set off at noon on our 120 mile run to Juba and a blistering hot run it was; a tyre burst on the road which nearly landed us in a ditch. We got on our next ship, the s.s. "Gedid," in time for tea, and during the evening were surprised to meet Guy Stanton, an R.A.S.C. Captain I had known in Malta, who had come in from some local outpost of the Empire.

February 27: We were off on our journey down stream at 6 a.m. and by 6.30 were firmly aground on a sandbank about 4 miles below Juba, which we could still see from the upper deck. Strenuous efforts with cables, anchors and the ship's winch failed to stir us, then two of our barges

were unhitched and anchored down stream and lastly the coal was shifted and we got off at 9.30 p.m., but as there was a risk of running aground again we tied up for the night. The only interest in a very hot day was a herd of forty-five elephant which was feeding close by and came within about 400 yards of us.

February 28: We moved off at dawn, very glad to see the last of Juba. At lunch time we got to a very small island on which was an interesting family party. A few years ago a fine bull and a cow elephant swam out to this island, presumably on their honeymoon; there is now a well-grown youngster to keep them company; they seemed to have adequate supplies

Pa, Ma and the Baby on an island below Juba in the White Nile.

but the island is pretty well eaten down. I got a couple of quite nice snaps of them. A little later we came on another group of three elephants quite near the bank, one was very annoyed at our disturbing his peace and stood with his huge ears forward, trumpeting loudly. We passed Mongalla in the evening, the deserted headquarters of the district.

The next two and a half days was spent in the Sudd area, a vast marsh with lakes and channels running through it; I had always pictured Sudd as being thick reed through which we would nose our way, but actually there was a well cleared channel through papyrus and reeds 12 feet high. Numerous sharp bends were negotiated by bumping into the papyrus and letting the current swing us round. Our craft consisted of the stern wheeler " Gedid " with a passenger barge lashed on at each side and two others in front for cargo, an unwieldy craft for a narrow river.

March 4: We arrived at Malakal at 6 a.m. and had time to get off a few air mail letters announcing our change of schedule owing to shipwreck. The departure from Malakal caused a certain amount of amusement; there was a strong wind blowing up stream which prevented our turning. Three

efforts were needed before we stopped spinning half round and back again and this caused a lot of local friction between the engineer and crew and one of them being rather flurried stepped into a crate of eggs; later, just as we got turned, one of the crew who had got left behind had to swim for the ship, to the delight of his friends. We had omelette for lunch.

March 6: We arrived at Kosti after a most perilous passage through the swing bridge, missing a most devastating crash literally by inches, a smart piece of steering of such an awkward craft, but a little hair raising while it lasted. A number of passengers disembarked and took the train to Khartoum, but as it was scheduled to arrive at 2 a.m. and would mean spending two days in an hotel instead of one, most of the first class decided to stay on the boat.

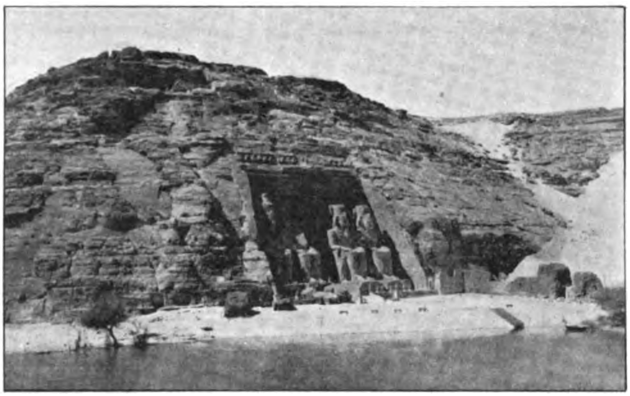
March 7: The rest of the run was through rather featureless desert country and we got to the new Gebel Aulia dam about 5 o'clock and through the lock before dark. The dam has just been completed and is reputed to be the longest dam in the world, a fine piece of masonry but not particularly beautiful. We tied up for the night with the Omdurman Bridge outlined against the sky and the lights of the huge native city twinkling ahead of us.

March 8: We were up in good time for our passage through the bridge and turned from the White Nile into the Blue Nile to go up to Khartoum, a mile or so up stream. We had heard such a lot of the river junction and how the different coloured waters met and ran alongside one another. Frankly, I didn't believe it, but it was a most astonishing fact that the two rivers ran in the same channel for quite a good bit before really mixing and one could see the demarcation quite plainly, particularly from the bridges. We were met by Herbert and Dorothy Walker, a gallant act at 6 o'clock on a cold morning, and taken first to the Grand Hotel to stake a claim on one of the few remaining rooms there, and then on to breakfast at their bungalow and a good "buck" about our travels. Later, Dorothy piloted us round the sights of Khartoum and Omdurman, the Khalifa's house with all its relics of Gordon's tragic stand in Khartoum, and of the battle outside Omdurman which put us in our present predominant position in Central Africa. Officials in the Sudan take themselves and their province very seriously indeed and one of our fellows a few years ago brought off a good leg-pull at a dinner party by saying "Who was this fellow Gordon that people talk so much about?"

March 9: We spent the day and night in the train for Wadi Halfa; a very comfortable train but hot and dusty and we were glad to get off at 9 a.m. on the 10th and embark on the s.s. "Lotus" for Shellal.

March 10: A very different Nile from what we had got accustomed to in our two and a half days in the Sudd; now the river was fringed with date palms and a strip of cultivation on either bank and beyond that was desert

stretching as far as we could see. We soon came on evidences of the raising of the river level by the Assuan dam 200 miles below, trees well out in the river which had obviously been recently on the bank before the level was raised. We got to the famous rock temple of Abu Simbel about 1 o'clock and had half an hour ashore to look over this wonderful monument to the greatness of Rameses II, a temple carved out of solid rock with four huge statues of Rameses 65 feet high; the temple itself goes back 185 feet into the solid cliff and must have been a stupendous task for the unfortunate slaves who had to hack it out.



Rock Temple of Abu Simbel on the Nile below Wadi Halfa.

March 11: We got to Shellal about midday and could see the Assuan dam in the distance; the water level was very high, so all we saw of the Temple of Philae was about three feet of the tops of the pylons flanking the entrance. Disembarking soon showed we were back in Egypt, thousands of flies and demands for "baksheesh" from every side; this is firmly discouraged in the Sudan, Uganda and Kenya, but it is so firmly engrained in the Egyptian make-up that nothing will eradicate it, but still it never ceases to irritate.

We got to Luxor at 7 p.m. and before we had been three minutes in the station, a Dragoman had firmly attached himself by assuring us that he belonged to the Hotel; he turned out quite well and didn't irritate us as much as we expected.

March 12: We joined up with our fellow passenger Somerville for a day across the river seeing the sights with our guide who was still adhering firmly; he knew his job and showed us just the right amount. We hired an aged Chevrolet when we got across the river and set off for the Valley of the Kings where we saw three tombs, Tutankhamen, of course, with its fine red granite sarcophagus and gorgeous gilded mummy case still in situ. The wall paintings were well preserved but nothing like as fine as those in

the tombs of Seti and Amenhopis which were really remarkably well preserved and might have passed for thirty years old instead of 3,000. A tomb of a noble was our next call, not quite on such a grand scale as the Kings' but with more human touches, farming scenes, the noble bringing down wild duck with a sort of boomerang affair, while his wife dutifully crouched at his feet presumably says "Good shot, darling" as a properly trained wife should. The Temples of Deir el Bahri erected to commemorate the victories of Queen Hathepsowet, the sister co-regent, and wife of Thutmosis III was interesting, but the lady must have been a strong-minded ruler and apparently did not endear herself to her brother-

Temple at Luxor with hills in background in which is the Valley of the Kings.

Temple of Karnak at Luxor.

husband for he effaced all her images after her death. We felt we had earned our lunch after this and escaped from our guide into a very comfortable rest house. After lunch we saw the Ramesseum; another great memorial to the greatness of Rameses II, a temple to the god Ammon; a huge statue of Rameses lies broken on the ground; it was made of a solid block of granite nearly 60 feet high but our guide assured us that it was broken by the Persians who lit fires round it for a fortnight and then doused it with cold water; their efforts whatever they were had been most successful.

Then another tomb with some beautiful wall paintings of the deceased and his wife at their household and farm avocations; in one corner they

are dining at a table underneath which is a cat having a good square meal of fish. The Valley of the Queens was our next port of call; the tomb of Nefertere, wife of Rameses II had a series of really beautiful paintings of the queen in various dresses which would have won her admiring glances in a modern ballroom.

The last tomb was that of a Prince, son of Rameses III, a rather pathetic series of excellent paintings of a small boy being introduced by his father to the various gods of the underworld and finally going off alone—all rather reminiscent of leaving one's offspring at school when one was going on a foreign tour. The Colossi of Memnon were passed on our way back

Colossi of Memnon at Thebes.

to the ferry and we were relieved when the guide did not start his usual preamble "This is statue (temple or monument) of Rameses II, Pharaoh of Nineteenth Dynasty 1300 B.C." We got to understand why the Persians disliked his statues for we got pretty tired of them ourselves.

We were glad of a bath and tea on our return to the hotel.

March 13: We took a carriage to Karnak and spent a couple of hours wandering round this immense temple covering several acres of ground erected to the god Ammon and added to by numerous Pharaohs; a magnificent hall was entered through a gateway nearly 150 feet high, and a series of aisles formed by pillars nearly 80 feet high was its main feature. The reliefs cut in the walls were still in a fine state of preservation, and chiefly represented the victories of some immense Pharaoh over his rather puny enemies. It was interesting to see how clearly the artists differentiated between Negroid and Semitic victims. We paid a visit to the Luxor Temple later but it fell a bit flat after Karnak and its magnificence. I seemed to do little but take photos as one delightful view succeeded another and was fortunate in getting a very nice lot of pictures.

efforts were needed before we stopped spinning half round and back again and this caused a lot of local friction between the engineer and crew and one of them being rather flurried stepped into a crate of eggs; later, just as we got turned, one of the crew who had got left behind had to swim for the ship, to the delight of his friends. We had omelette for lunch.

March 6: We arrived at Kosti after a most perilous passage through the swing bridge, missing a most devastating crash literally by inches, a smart piece of steering of such an awkward craft, but a little hair raising while it lasted. A number of passengers disembarked and took the train to Khartoum, but as it was scheduled to arrive at 2 a.m. and would mean spending two days in an hotel instead of one, most of the first class decided to stay on the boat.

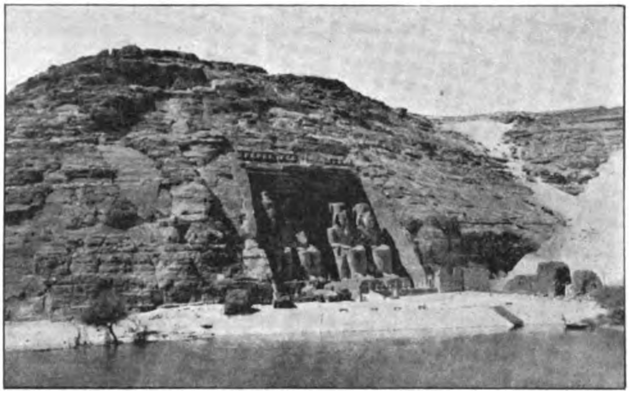
March 7: The rest of the run was through rather featureless desert country and we got to the new Gebel Aulia dam about 5 o'clock and through the lock before dark. The dam has just been completed and is reputed to be the longest dam in the world, a fine piece of masonry but not particularly beautiful. We tied up for the night with the Omdurman Bridge outlined against the sky and the lights of the huge native city twinkling ahead of us.

March 8: We were up in good time for our passage through the bridge and turned from the White Nile into the Blue Nile to go up to Khartoum, a mile or so up stream. We had heard such a lot of the river junction and how the different coloured waters met and ran alongside one another. Frankly, I didn't believe it, but it was a most astonishing fact that the two rivers ran in the same channel for quite a good bit before really mixing and one could see the demarcation quite plainly, particularly from the bridges. We were met by Herbert and Dorothy Walker, a gallant act at 6 o'clock on a cold morning, and taken first to the Grand Hotel to stake a claim on one of the few remaining rooms there, and then on to breakfast at their bungalow and a good "buck" about our travels. Later, Dorothy piloted us round the sights of Khartoum and Omdurman, the Khalifa's house with all its relics of Gordon's tragic stand in Khartoum, and of the battle outside Omdurman which put us in our present predominant position in Central Africa. Officials in the Sudan take themselves and their province very seriously indeed and one of our fellows a few years ago brought off a good leg-pull at a dinner party by saying "Who was this fellow Gordon that people talk so much about?"

March 9: We spent the day and night in the train for Wadi Halfa; a very comfortable train but hot and dusty and we were glad to get off at 9 a.m. on the 10th and embark on the s.s. "Lotus" for Shellal.

March 10: A very different Nile from what we had got accustomed to in our two and a half days in the Sudd; now the river was fringed with date palms and a strip of cultivation on either bank and beyond that was desert

stretching as far as we could see. We soon came on evidences of the raising of the river level by the Assuan dam 200 miles below, trees well out in the river which had obviously been recently on the bank before the level was raised. We got to the famous rock temple of Abu Simbel about 1 o'clock and had half an hour ashore to look over this wonderful monument to the greatness of Rameses II, a temple carved out of solid rock with four huge statues of Rameses 65 feet high; the temple itself goes back 185 feet into the solid cliff and must have been a stupendous task for the unfortunate slaves who had to hack it out.



Rock Temple of Abu Simbel on the Nile below Wadi Halfa.

March 11: We got to Shellal about midday and could see the Assuan dam in the distance; the water level was very high, so all we saw of the Temple of Philae was about three feet of the tops of the pylons flanking the entrance. Disembarking soon showed we were back in Egypt, thousands of flies and demands for "baksheesh" from every side; this is firmly discouraged in the Sudan, Uganda and Kenya, but it is so firmly engrained in the Egyptian make-up that nothing will eradicate it, but still it never ceases to irritate.

We got to Luxor at 7 p.m. and before we had been three minutes in the station, a Dragoman had firmly attached himself by assuring us that he belonged to the Hotel; he turned out quite well and didn't irritate us as much as we expected.

March 12: We joined up with our fellow passenger Somerville for a day across the river seeing the sights with our guide who was still adhering firmly; he knew his job and showed us just the right amount. We hired an aged Chevrolet when we got across the river and set off for the Valley of the Kings where we saw three tombs, Tutankhamen, of course, with its fine red granite sarcophagus and gorgeous gilded mummy case still in situ. The wall paintings were well preserved but nothing like as fine as those in

the tombs of Seti and Amenhopis which were really remarkably well preserved and might have passed for thirty years old instead of 3,000. A tomb of a noble was our next call, not quite on such a grand scale as the Kings' but with more human touches, farming scenes, the noble bringing down wild duck with a sort of boomerang affair, while his wife dutifully crouched at his feet presumably says " Good shot, darling " as a properly trained wife should. The Temples of Deir el Bahri erected to commemorate the victories of Queen Hathepsowet, the sister co-regent, and wife of Thutmosis III was interesting, but the lady must have been a strong-minded ruler and apparently did not endear herself to her brother-

Temple at Luxor with hills in background in which is the Valley of the Kings.

Temple of Karnak at Luxor.

husband for he effaced all her images after her death. We felt we had earned our lunch after this and escaped from our guide into a very comfortable rest house. After lunch we saw the Ramesseum; another great memorial to the greatness of Rameses II, a temple to the god Ammon; a huge statue of Rameses lies broken on the ground; it was made of a solid block of granite nearly 60 feet high but our guide assured us that it was broken by the Persians who lit fires round it for a fortnight and then doused it with cold water; their efforts whatever they were had been most successful.

Then another tomb with some beautiful wall paintings of the deceased and his wife at their household and farm avocations; in one corner they

are dining at a table underneath which is a cat having a good square meal of fish. The Valley of the Queens was our next port of call; the tomb of Nefertere, wife of Rameses II had a series of really beautiful paintings of the queen in various dresses which would have won her admiring glances in a modern ballroom.

The last tomb was that of a Prince, son of Rameses III, a rather pathetic series of excellent paintings of a small boy being introduced by his father to the various gods of the underworld and finally going off alone—all rather reminiscent of leaving one's offspring at school when one was going on a foreign tour. The Colossi of Memnon were passed on our way back

Colossi of Memnon at Thebes.

to the ferry and we were relieved when the guide did not start his usual preamble "This is statue (temple or monument) of Rameses II, Pharaoh of Nineteenth Dynasty 1300 B.C." We got to understand why the Persians disliked his statues for we got pretty tired of them ourselves.

We were glad of a bath and tea on our return to the hotel.

March 13: We took a carriage to Karnak and spent a couple of hours wandering round this immense temple covering several acres of ground erected to the god Ammon and added to by numerous Pharaohs; a magnificent hall was entered through a gateway nearly 150 feet high, and a series of aisles formed by pillars nearly 80 feet high was its main feature. The reliefs cut in the walls were still in a fine state of preservation, and chiefly represented the victories of some immense Pharaoh over his rather puny enemies. It was interesting to see how clearly the artists differentiated between Negroid and Semitic victims. We paid a visit to the Luxor Temple later but it fell a bit flat after Karnak and its magnificence. I seemed to do little but take photos as one delightful view succeeded another and was fortunate in getting a very nice lot of pictures.

A few notes about distances travelled and approximate costs may be of interest. I did not keep an accurate budget. First of all distances:— Suez to Mombasa, 3,000 miles; Mombasa to Nairobi, 330; Nairobi to Nimule, 850; Nimule to Juba 120; Juba to Khartoum on White Nile, 1,090; Khartoum to Wadi Halfa, by train, 580; Wadi Halfa to Shellal by Nile Steamer, 208; Shellal to Cairo, 560 by Egyptian State Railway. A total of 6,700 odd miles. The Tourist class fare from Suez to Mombasa, nearly 3,000 miles, was £30 10s., about £4 10s. less than the fare from London to Mombasa. On the Sudan, Kenya and Uganda Railways, half fares are allowed to serving officers and their wives and when one travels second class it makes a very great difference to one's expenses. I am quoting the second class half fares except where specified; Mombasa to Nairobi 25s., Nairobi to Nimule by rail, steamer and road £4. The diversion to Murchison Falls was £2 5s. extra. Meals on this part of the journey cost about 10s. per day. The motor run of 120 miles from Nimule to Juba was expensive, costing £5 per head, but the cost of maintaining a fleet of cars in Central Africa must be taken into account.

The journey from Juba to Shellal first class cost £13, meals on this part of the journey cost 16s. per day, less a rebate to officers and families.

Special inclusive tickets covering rail travel, bedding and catering are issued on the Kenya-Uganda Railways and Sudan Railway; plenty of notice should be given to Railway authorities for this when taking advantage of half-fare concessions.

From Shellal to Cairo full first class fare is £3 10s. and half-fare is only allowed to officers.

If stopping to see the sights at Luxor a special "Antiquities" pass issued from Army Headquarters in Cairo allows one to visit all the temples and tombs free of charge, a very considerable saving.

Hotels in Kenya varied from 14s. to 18s. per day, with special rates for longer stay.

The Kenya-Uganda Railway Company headquarters at Nairobi publish an excellent Travellers' Guide, full of information and pictures, and the Company does everything in its power to make the tourist comfortable.

Altogether I can very strongly recommend a trip in Kenya as a delightful way of spending a three-months leave; beautiful scenery, delightful climate and people, where every prospect pleases and only roads are vile!

Current Literature.

MITCHELL, J. P. **On the Causes of Obstructed Labour in Uganda.** *E. African M. J.* 1938, v. 15, 177-89 ; 206-12, 5 text figs. & 6 figs. on 3 plates. [13 refs.]

COOK, A. **Note on Dr. Mitchell's Paper on the Causes of Obstructed Labour in Uganda.** *Ibid.* 213-17.

STONES, R. Y. **On the Causes of Obstructed Labour in Uganda.** [Correspondence.] *Ibid.* 217-19.

The incidence of obstructed labour in Uganda is high, contrary to the prevalent belief that African women have little or no difficulty in parturition. There is no poverty in Uganda, the women are active, obtain abundance of good food and sunshine and rickets is unknown, yet abnormal distress in labour is frequent and the incidence of fœtal and maternal casualties from disproportion is high. Long acquaintance with labour difficulties is suggested by certain customs, Baganda women are known to be poor breeders, a woman being regarded as remarkable if she has produced more than one child. One operation of cæsarian section was frequently practised by the African surgeon in the past, a detailed description of the method is quoted from an observer in 1878. The practice is still prevalent in cases of delayed labour of giving native medicine reputed to be ecbolic, but the author has investigated many of the herbs used and denies that they have power to increase uterine contractions, the only action produced being gastro-intestinal irritation.

Evidence of the high incidence of obstructed labour is shown by figures from two maternity hospitals, where in over 5,000 confinements the maternal death-rate was 4·6 per cent, two-thirds of these being due to obstruction, and the still-birth rate was 10 per cent, while in district centres it has reached 50 per cent.

The character of the local female pelvis as the cause of obstruction is discussed and the views of other writers mentioned. The author denies that flattening due to excessive weight-carrying in childhood occurs and states that the decrease in difference between intercristal and interspinous measurements (average $\frac{1}{2}$ to $\frac{3}{4}$ inch) is due to narrowness of the negroid hip. The Baganda pelvis is generally smaller and the inlet more rounded than in white races, the true conjugate being relatively longer. A comparison is made between the normal male and female Baganda pelves and it was found that the male character of acute supra-pubic arch and

straight pubic rami occurred in all the female pelves examined. This ischio-pubic sex inversion pelvis has been described in European female bones and is apparently normal in the female of black races. The striking point in the pelves of five women who had died from obstructed labour was that each showed in addition the ilio-sacral type of sex inversion with acutely angular and narrow sacro-sciatic notch and the outlet encroached on by the ischial spines and sacral tip, forming a typical funnel pelvis.

In discussing future possibilities of investigation to prevent this high incidence of obstructed labour, Dr. Mitchell states that examination by X-ray appears to be the only method of recognizing this condition of contracted outlet during pregnancy. External measurements and fitting the head are misleading, as the head will enter the brim but is arrested in mid-pelvis and will not pass the outlet without fatal moulding, cæsarian section being the only solution. This contraction of the outlet due to ilio-sacral inversion, a hereditary stigma with which the Baganda are inflicted, occurs, in the opinion of the author, in a high incidence and is the cause of many fatalities, both fœtal and maternal, in primiparæ. [This article is illustrated by an excellent series of drawings and photographs of the types, normal and abnormal, of Baganda pelves.]

Sir Albert Cook deals with two points where the above author dissents from his views. He states that carrying heavy weights in childhood as a cause of flattening of the pelvis is a fact which rests upon sound mechanical principles and that a flat pelvis is by no means rare amongst Baganda women, the average true conjugate taken from some 2,000 pelvic measurements being 3·56 inches.

Referring to the dangers of native herbs, he mentions that Baganda preparations are infusions made from fresh herbs and may contain ecbolic properties, not shown by tests made with dried herbs. He stresses the importance of teaching the danger of reliance on native medicine, since faith in its efficacy seriously delays recourse to skilled help.

Dr. R. Y. Stones urges the necessity for further examinations of the bony pelvis to obtain a real standard of pelvic measurements of Baganda women and to find the true relationship between pelvis and fœtal skull. The ill-effects of native medicine are too readily accepted as a cause of obstruction labour and this should not be allowed to mask the need for further investigation.

The Baganda are an intelligent people and already there are signs that they realize the value of ante-natal examination and the opportunity of safe delivery which this affords their women. As a result, early causes of obstruction should be revealed with a lessening of the excessive still-birth and infant mortality rates.

H. M. Davis.

Reprinted from "Bulletin of Hygiene," Vol. **14,** ***No.*** 2.

J. INST. HEATING & VENTILATING ENGINEERS. **The Ventilation of Flueless Rooms.** 1938, v. 6, 428-34, 2 figs.

The paper gives detailed results of experiments made some years ago and briefly referred to in the Report of the Building Research Board for 1927. The tests were made in two similar rooms, each of 1,560 cubic feet capacity, in the experimental house at the Building Research Station. The ventilation was determined by measuring the increase of carbon dioxide consequent upon the burning of three standard candles for three hours.

With flues and ventilators sealed and the doors and windows shut the average rate of ventilation was 0·47 air changes per hour. With a low wind velocity, and with the indoor temperature practically the same as that outside, a ventilator of 8 square inches effective aperture, and a flue 9 inches square and 25 feet high with an effective aperture at the bottom of 45 square inches, gave equal ventilation values—0·51 air-changes per hour. With more wind (6 to 9 miles per hour), but with the temperature difference still small, the increased ventilation was much the same (ventilator 0·71 changes, and flue 0·77 changes per hour). With low wind velocity, but with the room 9° F. warmer than outside, the ventilator results were unaffected (0·51 changes), but the temperature difference enhanced the effect of the flue (0·87 changes). When the effect of the 8 square inch ventilator was compared with that of a 115 square inch opening made by removing a pane of glass, the ventilation was doubled (0·71 to 1·49 changes). Attention is drawn to the fact that in a flueless room with an ordinary wall ventilator, the air-change may fall as low as 0·3 per hour or less, even when the room is heated. T. BEDFORD.

Reprinted from "Bulletin of Hygiene," Vol. 14, *No.* 2.

SCHLIRF, K. Ueber die bakteriologische Diphtheriediagnose. Zugleich ein Beitrag zur Diphtheriebazillendifferenzierung. Mitteilung aus der Untersuchungspraxis. I. Teil. [**On the Bacteriological Diagnosis of Diphtheria. Part I.**] *Zent. f. Bakt.* I. Abt. Orig. 1938, v. 142, 1-14.

This paper discusses the use of Clauberg's media in the macroscopic diagnosis of diphtheria and compares these media with that of Löffler. Clauberg's medium No. 2 proved a selective and diagnostic medium of considerable value. *C. diphtheriæ* forms characteristic colonies on the medium which can be recognized by the naked eye or with a hand lens. Difficulties were, however, sometimes encountered and certain diphtheroids were difficult to distinguish from *C. diphtheriæ*. The Neisser staining of *C. diphtheriæ* grown on this medium was for the most part typical. In the diagnosis of actual cases of diphtheria a twenty-four-hour incubation is sufficient, but when examining carriers and contacts the plates should

be read after forty-eight hours. The special advantages of Clauberg's medium No. 2 is that it is, when once prepared, time-saving and that by giving typical Neisser staining it is easy to check up doubtful colonies microscopically.

Clauberg's medium No. 3 is less complicated to prepare than Clauberg's No. 2. It is very satisfactory for the examination of actual cases of diphtheria, and generally gives a diagnosis in forty-eight hours. It proved, however, less satisfactory in the examination of carriers and contacts, in this respect being distinctly inferior to Clauberg's No. 2. The characteristic blue colony of *C. diphtheriæ* can be simulated very closely by certain other diphtheroids and even by cocci, and this detracts greatly from its value as a diagnostic medium. The medium also gives poor and atypical Neisser staining. Though Clauberg No. 2 is more difficult to prepare, it is recommended in preference to Clauberg No. 3, particularly for the examination of carriers, convalescents and contacts. C. C. OKELL.

Reprinted from "Bulletin of Hygiene," Vol. 14, *No.* 2.

SCHLIRF, K. Ueber die bakteriologische Diphtheriediagnose. Zugleich ein Beitrag zur Diphtheriebazillendifferenzierung. Mitteilung aus der Untersuchungspraxis. II. Teil. [**On the Bacteriological Diagnosis of Diphtheria. Part II. The Typing of** *C. diphtheriæ*.] *Zent. f. Bakt.* I. Abt. Orig. 1938, v. 142, 14-31. [23 refs.]

Various media were compared as to their suitability for use in typing *C. diphtheriæ* into *gravis*, *mitis* and "intermediate." Clauberg's medium No. 2 proved suitable for this purpose though it gave difficulty in certain cases. Clauberg's medium No. 3 gave no characteristic differentiation of types. Simple agar media also proved useless for the purpose. The tellurite medium introduced by Anderson, Happold, McLeod and Thomson [this *Bulletin*, 1932, v. 7, 59] was very satisfactory, but is somewhat difficult to prepare. Gundel and Tietz's medium is more simple to prepare and is satisfactory for type differentiation. It fails, however, to give a typical Neisser staining. A medium of 10 per cent sheep's blood in agar proved to be as satisfactory as Gundel and Tietz's medium for type differentiation and at the same time gave typical Neisser staining. This medium is very easy to prepare and is recommended for routine use.

For the biochemical classification of *C. diphtheriæ* peptone water proved a valuable nutritive basis. Glucose, sucrose and starch could be added to the peptone water and the extent of fermentation judged by titration with N/40 NaOH after three days' incubation. By this method *gravis*, *mitis* and "intermediate" strains and diphtheroids could be distinguished.

The use of an indicator in the medium failed to give such clear results as the titration method.

To summarize—the author considers Clauberg's medium No. 2 the best medium for the routine diagnosis of *C. diphtheriæ*; for the type differentiation of colonies he recommends 10 per cent sheep's blood agar. Colony appearance should be confirmed by the fermentation of glucose, sucrose and starch in peptone water. C. C. OKELL.

Reprinted from "Bulletin of Hygiene," Vol. 14, *No.* 2.

CROWDEN, Dr. G. P. and ANGUS, T. C. **The Control of Indoor Environment by Air Conditioning with special reference to the Tropics.** *Journal of the Institution of Heating and Ventilating Engineers*, Vol. VI, No. 69, November, 1938.

Attention has been drawn to the following misquotations which appeared in the commentary on this paper given in the *Journal of the Royal Army Medical Corps*, vol. lxxii, No. 1, January 1939, pp. 61-64.

Page 61: 6th line from the bottom of page insert the words "body temperature" before the word "control."

Page 62: Line 19. 50°F. *should read* 59°F.
Line 21. 74°F. *should read* 79°F.

Page 63: Line 32. Paragraph commencing Line 32 refers to an experiment in which the outside conditions were 90·5°F. Dry Bulb and 77°F. Wet Bulb. The data shown were those observed early in the experiment in question. For full records of the experiments and the Discussion which followed, the original paper should be consulted.
Line 35. Wet Bulb 69°F. *should read* 68°F.

Reviews.

SIR JAMES CANTLIE: A ROMANCE IN MEDICINE. By Neil Cantlie and George Seaves. London: John Murray. Pp. xxviii + 279. Price 10s. 6d. net.

This is a book which is certain to be widely read both by medical men and laymen. Sir James Cantlie's life makes a fascinating story which has been extremely well told by the authors of this volume, and his career and the record of his many outstanding achievements deserve to be studied by all who are entering the medical profession. In tbe book the rather beautiful family life of the Cantlies is described with praiseworthy restraint; and as the source of much of this information was her private diary, the exceptionally fine character of Lady Cantlie can also well be recognized and appreciated.

In the Introduction Sir Arthur Keith writes a noble eulogy in praise of his old and beloved friend, strongly biased as he frankly states, but who will blame him after reading what he has to say?

Cantlie's Celtic temperament is clearly shown in this story of his life, but his was not the gloomy romanticism of the Gaelic Celts with whom we usually associate the word Celtic. It is therefore most interesting to find so distinguished an authority as Sir Arthur Keith proclaiming a Pictish descent for those who, like Cantlie and himself, have come from stocks which have been settled for centuries in Eastern and North-eastern Scotland. The influence of the Pictish race in the formation of the character-pattern which we recognize as Scottish is but faintly acknowledged by historians, and certainly deserves wider recognition. Sir James Cantlie's special genius lay in his ability to conceive new ideas for the betterment of his fellow men, and he had the "drive" to see those ideas converted into practice.

The chief interest his life-story has for officers of the Royal Army Medical Corps is that he was the founder and original Commandant of the Volunteer Medical Staff Corps in 1885, and this unit has developed since that time into the large and complex organization known to-day as the R.A.M.C.(T.A.). It is of almost equal interest to us that he compiled the Handbook of the St. John Ambulance Association and that he founded the *Journal of Tropical Medicine and Hygiene.* Lastly, it is a matter of no little interest to readers of the *Journal of the Royal Army Medical Corps* that Sir James Cantlie's biography has been written (in collaboration) by his son, Lieutenant-Colonel Neil Cantlie, M.C., R.A.M.C. The book itself makes most excellent reading and is strongly recommended to readers as a notable contribution to present-day biographical literature.

W. J. F. C.

A SYNOPSIS OF MEDICINE. By Henry Letheby Tidy, M.A., M.D., B.Ch.Oxon, F.R.C.P.Lond. Seventh Edition, 1939. Bristol: John Wright and Sons, Ltd. Pp. xx + 1187. Price 21s.

This well-known and deservedly popular manual is one that has a special appeal to members of the Services. The binding is sturdy, the printing all that could be desired, the size and weight reasonable, yet within this limited compass is to be found a mass of information which in its comprehensiveness would shame many a so-called encyclopædia. No subject of importance fails to receive due attention, and the degree of detail given is far beyond that suggested by the modest title "Synopsis."

The reduction in bulk is achieved by writing the sentences in the form of notes; that is, leaving out all unnecessary words. This does not in any way obscure the meaning, and the saving in space is remarkable.

The arrangement of the subject-matter follows orthodox lines, and by means of ample, clear and logically arranged cross headings it is presented in a manner which might well be described as graphic. Sections are devoted to specific infectious diseases, to diseases due to physical agencies

and to the intoxicants, to diseases of metabolism and of deficiency, and to diseases of each of the systems. Pains have been taken to incorporate recent advances which have found general acceptance, but it is rather surprising to find that the sulphonamide drugs receive only the briefest mention.

In a comprehensive work such as this it is inevitable that minor discrepancies must occur, especially in those subjects which lie outside the normal province of the physician. Thus (to mention one or two which caught the eye of a bacteriologist) it is recommended, under amœbic dysentery, that a search should be made for cysts in portions of mucus, where in fact they are rarely if ever found; the tetanus bacillus is stated to be recognizable in pus by its morphological appearances, whereas at least two other harmless saprophytes are indistinguishable from it, and the unit of tetanus antitoxin is incorrectly defined. Trifles such as these in no way detract from the fundamental soundness of the work, which is guaranteed by the ripe experience of its author.

This book can be strongly recommended to every medical officer in the Services, as it is peculiarly suited to the needs of those who must of necessity possess as portable a library as possible. J. S. K. B.

Notices.

THE ROYAL SANITARY INSTITUTE.

SANITARY PROBLEMS OF EVACUATION OF THE CIVILIAN POPULATION.

The proposed Government scheme to evacuate part of the civilian population from certain areas is likely to lead to problems arising in regard to health matters in the billeting areas or in the special camps that may be set up. To assist the health authorities of the reception areas the Council of the Royal Sanitary Institute have arranged for a series of lectures and demonstrations to be given dealing with sanitary problems of evacuation of the civilian population. The lecturers will be Sir Wilfred Beveridge, a former Director of Hygiene, War Office, and Mr. H. H. Clay, of the London School of Hygiene and Tropical Medicine. The lectures will be given at the Institute, 90, Buckingham Palace Road, London, S.W.1, and will commence on Monday, June 19, continuing until Friday, June 23. A visit will be arranged to the Army School of Hygiene at Aldershot. The course will be open free of charge to members and associates of the Institute.

A RESPIRATORY AND CARDIAC STIMULANT.

"NICAMIDE" Nicotinic Acid Diethylamide is stated to be a powerful respiratory and cardiac stimulant, and is prepared by Burroughs, Wellcome and Co., Snow Hill Buildings, London, E.C.1. It is available to the medical profession as a 25 per cent solution for oral administration in bottles of 15 c.c. and 100 c.c., and as "Hypoloid" "Nicamide," a 25 per cent solution for intravenous or intramuscular injection in ampoules of 2 c.c. and 5 c.c. Following the administration of "Nicamide," depth and frequency of respiration are stated to be stimulated, and the force of cardiac contraction to be increased. The drug is believed to cause a rise in blood-pressure probably brought about by reflex stimulation of the vasomotor centre through the carotid sinus. "Nicamide" is non-toxic and acts effectively either by mouth or by injection. The indications for the use of "Nicamide" include all conditions associated with shock and depressed circulatory and respiratory states.

M AND B 693.

We are informed by Messrs. May and Baker that a prominent feature of the Glasgow Medical Exhibition was the display of the new drug, M and B 693 or Dagenan.

The anti-pneumococcal activity of this drug is now well-established. The anti-gonococcal activity of M and B 693 is no less remarkable. It was referred to in a recent issue of the *British Medical Journal* as "the most effective therapeutic agent yet introduced in the treatment of gonorrhœa."

M and B 693 is believed to owe its remarkable anti-pneumococcal activity to its power of destroying the outer capsule of the pneumococcus, thus rendering it more vulnerable to the attack of the white corpuscles.

Amongst other preparations displayed on the stand, Proseptasine and Soluseptasine were prominent. The former is the benzyl derivative of sulphanilamide, and has been shown to be much less toxic than sulphanilamide itself. Soluseptasine provides a colourless sulphonamide preparation in aqueous solution for injection by any route. Like Proseptasine, it is intended for the treatment of streptococcal infections.

INDEX TO VOLUME LXXII.

C.N. = Clinical and other Notes.
C.L. = Current Literature.

EDITORIAL NOTICES.

The Editor will be glad to receive original communications upon professional subjects, travel, and personal experiences, etc.

Correspondence on matters of interest to the Corps, and articles of a non-scientific character, may be accepted for publication under a nom-de-plume.

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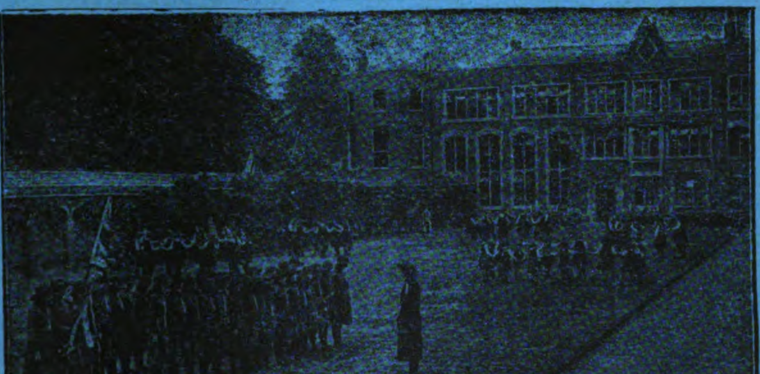

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Journal

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EDITED BY

COLONEL SIR WILLIAM H. HORROCKS, K.C.M.G., C.B.

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VOL. LXXIII.

July—December, 1939.

JOHN BALE, SONS & CURNOW, LTD.
83-91, GREAT TITCHFIELD STREET, OXFORD STREET, W.1.

No. 1. July, 1939. Vol. LXXIII.

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OF THE

Royal Army Medical Corps

IN ARDUIS FIDELIS

ISSUED MONTHLY

EDITOR.
COLONEL SIR WILLIAM H. HORROCKS, K.C.M.G., C.B.

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JOHN BALE, SONS & CURNOW, LTD.
83-91, GREAT TITCHFIELD STREET, LONDON, W.1

Price Two Shillings and Sixpence net

VOL. LXXIII. JULY, 1939. No. 1

Journal
of the
Royal Army Medical Corps.

Original Communications.

THE WORK AT THE RECRUITS' PHYSICAL DEVELOPMENT DEPOT, CANTERBURY.

"THE UNDERSIZED RECRUIT."

BY MAJOR J. A. CRAWFORD,
Royal Army Medical Corps.

CONTENTS.

INTRODUCTION.

IT has been known for some time that medical officers examining recruits frequently have before them men who, although they present no signs of active disease, yet fail to reach the physical measurements laid down in the Regulations for Recruiting. These men have been rejected. In view of the need for recruits it was decided to attempt to try and bring such men up to the standard required. A sample, about thirty in number, was selected and put through a physical training course at the Army School of Physical Training at Aldershot, with results so encouraging that

it was determined to develop this idea on a larger scale. Thus, a recruits' depot of a unique character was formed, the object of which was to provide training of a specialized kind for youths who desired to join the Army but did not reach the required standards for recruits. This depot in no way supplants any of the work undertaken in the ordinary Regimental Depots but is rather a preliminary training to fit youths for admission to the Army.

The Depot, known as the Recruits' Physical Development Depot, or for short the R.P.D.D., was formed to accommodate three hundred recruits. The staff consists of a Commandant, an officer to act as adjutant and quartermaster, an officer in charge of physical training and a medical officer who has specialized in hygiene. In addition to an administrative staff there is a serjeant-major instructor, two serjeant-instructors, and several corporals. All these are specialists in physical training, and many have had special instruction in remedial work.

At the new depot the recruit receives the minimum of military training and the maximum of physical training. Only sufficient drill is done to enable the recruits to be moved about in an orderly fashion. No rifles are seen at the depot. The time is spent in carrying out physical, recreational, educational, and religious training.

The recruits received are of two main classes. "Undersized Recruits" and "Borderline Recruits." They come largely from the recruiting zones and to a smaller extent from depots and regiments. An "Undersized Recruit" is one who has not come up to the recognized standards as regards height, weight, and chest measurement. A "Border-line Recruit" is one who has a defect of such a nature that the examining medical officer would not feel justified in accepting him without a period of observation under appropriate care. This category would include such cases as general debility, flat foot, certain tachycardia cases, scoliosis, certain forms of neurasthenia and so on. Of course, numerous cases belonging to both groups are dealt with at the depot. Such cases are classified according to the most prominent defect presented at the time of recruiting.

The Raw Material.

A general study of the undersized group of cases reveals that for a given age almost 98 per cent are below weight and about 80 per cent are in addition under the requisite maximum chest measurement. If asked what is the reason for these men being undersized, the answer is that there is not one reason but a great many. Let us narrow down our scope of investigation at this point and leave aside cases which prove to have a pathological lesion which is retarding development but which may, or may not, be showing clinical signs, and also those who have a definite history

of past illness and have never made up the leeway. This leaves a large group of undersized recruits who have never seen their doctor at any time except to register on the panel. They give no history of those vague symptoms which are so valuable as pointers to the beginning of chronic lesions.

It is as well to avoid confusing cause and effect in dealing with these recruits. A very typical case is that of enlarged tonsils, septic or otherwise, which are often stated to be the cause of the recruit being undersized. It is interesting to note that undersized recruits who have chronically enlarged or septic tonsils are about equal in number to recruits who have had their tonsils removed in infancy or at school. I do not, of course, doubt the benefit of tonsillectomy in suitable cases, but enlarged tonsils are not in my opinion the cause of these recruits being undersized. Bronchitis of a chronic nature is often found on X-ray examination of the lung, and was at first believed to be the cause of the recruit's condition, especially when it was observed that when the bronchitis had disappeared the recruit attained a higher physical standard. Actually, of course, the bronchitis disappeared when the recruit's physical condition had improved. No drugs were given.

However, to come back to those recruits who show no signs and give no history of disease, in the majority of cases they come from that part of the community who are employed in factories and they may, or may not, be economically badly off. Few of these recruits come from the country or are employed in agricultural work or in an open-air occupation. A typical history would be that the lad comes from an industrial town. His parents are generally of the working class and often in good employment. The family lived in an overcrowded district and he himself shared a small bedroom with one or two other members of the family. He would have been born during the period 1919-21, just after the passing of the Maternity and Child Welfare Act of 1918 in which it will be remembered provision was made for supervision of children between the ages of 2 and 5 years. At that period the infant mortality rate was 89 per 1,000 registered births, and the maternal mortality rate was 4·37. The Milk and Dairies Act of 1923 which graded milk and laid down penalties for the sale of "reconstructed" milk and other adulteration was not in force. The various housing acts had not yet been consolidated in the Housing Act of 1925 which dealt with "unhealthy areas" and "reconstruction" schemes. Overcrowding was exceedingly prevalent at the time of his birth and housing accommodation far behind requirements owing to the World War. The Town Planning Act, 1925, was not in existence and the term "Ribbon Development" was unheard of. Notification of puerperal pyrexia and ophthalmia neonatorum came later, and provision for the adequate treatment of tuberculosis was only made compulsory in 1921.

Usually he was born at his home, but history regarding this important event is sadly lacking. The history of his early upbringing is usually vague, and accurate information about health between the ages of 2 and 5 years is difficult to get. Many recruits have suffered from one or other of the zymotic diseases, and a few of them mention complications arising from these illnesses. Occasionally infantile paralysis and rheumatic fever are admitted, but of course no statistical evidence can be of value as no recruit admits to a serious past illness for fear that he will be rejected by the examining medical officer. A history of post-diphtheritic paralysis has been recorded on two occasions, but one of rheumatic fever is only forthcoming when the recruit is confronted with some recurrence, cardiac or otherwise, of signs of the disease. This is to be regretted as very useful information might come to light if an accurate past history were obtainable.

Later the child, at the appointed time, went to school. Here he was seen by the school doctor, who, if he found any ailment, recommended suitable treatment which appears to have been acted upon or not according to the whim of the parent. At school, if he showed any ability at all, it was not of a very high standard. For recreation he played in the school playing ground, street, or public park. Only if he were destitute would he be provided with meals at school. His food as provided by his family was barely sufficient in quantity for his needs, and that is about all that can be said for it. He had not been a Boy Scout nor had he belonged to such organizations as the Boys' Brigade.

Thus he comes to the age of 14 years and he must work. If he is fortunate he is apprenticed to a trade or becomes a miner in a pit. If he is less fortunate he becomes a casual labourer, message boy, or engaged in some such "dead end" employment. While thus employed he has usually been too exhausted at night to undertake physical culture classes or take part in games, even if opportunity to indulge in these presented itself. He spends his leisure hours wandering about the streets, visiting cinemas, and being a spectator at football matches.

Contrary to expectation, he would be asleep by 10 or 11 o'clock at night as otherwise he could not do his work properly next day. In regard to his habits, generally they were not of a vicious nature. Smoking and drinking to excess were not indulged in, and lack of funds acted as a definite deterrent to indulgence. His sexual life was generally limited to love affairs with the girl friends of the family, or as often as not he avoided women.

I have carefully refrained from taking this general statement of history from extreme cases, e.g. lads from depressed areas, bad homes, and those who were made victims of unscrupulous relations or employers.

This is the type of lad who, wishing to better himself, comes to the

Recruiting Office. The astounding thing about a history of this sort is its negativeness. What strikes one is not so much what these lads have done as what they have omitted to do under the stress of circumstances or through ignorance. Especially is this so with regard to their physical development. In the horticultural sense they have grown rank. Their opposite number in the country works in the open air and in the bright sunshine of summer. The fishermen have the open sea to help them develop, and the nature of their employment naturally develops the whole of the musculature, but chiefly their chests. But these lads spend their days at some such job as putting bicycle frames on travelling carriers one after the other in deadly monotony, work in cotton mills in a hot damp atmosphere for long hours, necessitating carrying with them two meals a day, breakfast and dinner, or their employment is in coal mines in a space just sufficient to enable them to work, poorly illuminated and often exceedingly damp. No provision has been made for proper and adequate physical culture in the fresh air, nor for organized games to compensate their bodies for the bad results of their occupation.

The food provided for them is entirely inadequate, both in quantity and in quality, for growing youth. It consists largely of tea and white bread. Breakfast is tea, white bread, perhaps fried bread and a sausage, usually of the meaty kind. Dinner taken to their work consists of thick slices of white bread made into sandwiches with bacon, cheese or meat. These may be made with margarine, and always there is the can of cold tea. Supper is the meal of the day, and as often as not consists of fried bread, steak, a cheap vegetable, and on Sundays there may be a roast for the midday meal. Fruit, eggs in winter, and butter are luxuries. Fish is an alternative to meat, and fried fish and chips from the fish shop round the corner is enjoyed on Saturday nights. The Cockney as a class does himself better and varies his diet much more than those from industrial areas further north. There is marked limitation of vitamins, especially the fat soluble ones, so that vitamin D may be said to be almost entirely absent. Not only does his diet provide little of it, but also his employment under cover all the year round and living in smoke-laden industrial towns prevents his skin manufacturing it from the sun's radiation. It is considered that his physical condition, about to be described, is the result of the lack of an optimum diet, of sufficient bodily exercise and of good environment.

The nature of this existence is borne out in the facial expression, which would be properly termed a "pinched" expression and "strained" look. He may be of a happy disposition, but usually is not. Intellectually he is dull and his school teaching has often been forgotten. When stripped, his skin is unhealthy looking, he is scraggy and thin, and there is a lack of proper clothing of adipose tissue. The muscles are under-developed and

what there is of them stiff. His joints are also stiff and his co-ordination of movement is very bad. He has very little knowledge of how to breathe properly. Generally his oral hygiene is bad and his dental condition requires immediate attention.

His general posture is what is called "bad posture," a comprehensive term signifying the errors of lounging when sitting and lounging when standing. He may have a kyphosis either limited to the 10th to 12th dorsal vertebræ or extending upwards until he has definite round shoulders. He may also show a compensatory lordosis or a scoliosis, or any combination of these conditions. There may be a tilting upwards of the inlet of the pelvis and a sagging at the knees with all the body weight passing through the heels to the ground. The toes may be turned outwards with a lowering of the arches of the feet. Perhaps a definite flat foot is present. Splay foot, hallux valgus, and over-lapping toes may also be observed. The chest is flat or even concave and the shoulder blades wide apart, the flexor groups of muscles are contracted and the extensor groups are stretched. The pectoral muscles are shortened and he cannot brace back his shoulders.

These features can be seen in all stages as a result of lack of muscular tone. The erector spinæ is the first to give and the bodies of the vertebral column fall forward, beginning at the 10th to 12th dorsal vertebræ and extending upward as the muscular weakness becomes more evident, until kyphosis of the mid-dorsal region supervenes. In exceptional cases the spread is downwards to the lumbar vertebræ. As this process advances fibrotic changes take place in the muscles and the malformation becomes permanent. The thorax falls forward; the intercostal spaces become diminished in size; the intercostal muscles contract and the thorax is incapable of expanding. The chest is then held in a fixed position of more or less contraction and in consequence the lower margins of the ribs form a very acute angle at the base of the sternum.

Very seldom if ever are the lungs fully expanded and they with the heart and circulatory system are poorly developed. Examination by X-ray of the chest frequently demonstrates a low type of bronchitis. The blood stagnates in the tissues and organs of the body, especially in the splanchnic area. Anæmia of the microcytic variety with a reduction in hæmoglobin is present in many cases. Adequate aeration of the blood is interfered with and the proper supply of the products of metabolism by the blood-stream and lymph to the tissues generally, is slowed down. In addition the only food available is far below the optimum diet and it is very doubtful if the glands of the body, including the endocrine glands, receive chemical material sufficient for their development and their harmonious functioning within the organism. Thus a vicious circle is set up and the body is in a state of chronic malnutrition. The most noticeable feature of the nervous

system is lack of muscular control and co-ordination of movement with some degree of nervous instability.

Of course all these signs are not by any means present in every case, and when present, they vary in their intensity. One or other may be the only sign present. On the other hand they may be all seen to such a degree as to give rise to marked deformity or definite pathological conditions.

Such, more or less, is the straightforward and uncomplicated condition of an undersized recruit. As might be expected these cases may have their course complicated by the presence of definite pathological processes which hinder or prevent normal development. These conditions may be superimposed upon the evil effects of the under-development already existing.

There is, however, another type of lad who comes to us. His history shows that he has always been an ailing child, and of this type the rachitic child is the most common. Others have been difficult to bring up from their earliest babyhood and have required "a lot of looking after." They may have "never been the same since they had the measles," or whooping-cough, or they may give no history at all. These lads generally show the signs of severe malnutrition.

Another type of recruit is the one who has been at one time up to standard but has lately fallen on bad times and his food has been hard to come by. His chest measurement is usually above the standard required and a proper diet rapidly restores the lost condition of his body.

Lastly, there is a small group where the condition may be aggravated by mental worry and even result in neurasthenia. This has not in my experience been a large group, but it has been a very interesting one. Where the home life is not happy and where continuous mental strain and worry have to be borne by a youth, he will continue to show signs of poor development despite the provision of good environment and good food with adequate exercise.

I have carefully refrained from dwelling on what is commonly spoken of as the mental outlook of these recruits. They know that there is a difference between them and other lads of their age, and they know, although they may not admit it, that they are bodily weaker. Many are unable to account for this. Others can account for it but find themselves unable to take correct measures to rectify the position of affairs, either because they cannot afford it or else because they cannot or will not make up their minds about it. One of the striking results of training is the complete alteration of mental outlook as a result of having made an effort and overcome the physical defect.

How the Problem is Tackled.

The method adopted for dealing with undersized recruits at this depot is based on six cardinal principles, viz.: (*a*) Good environment; (*b*) sound sleep over long periods; (*c*) hard work; (*d*) healthy recreation; (*e*) good food; (*f*) contentment.

We have come to the conclusion that this is the order of importance from the point of view of fitness for service. But throughout training the secret of success is individual attention.

The environment is similar to that which has been found so successful in Regimental Depots. Sufficient and modern housing is provided, and the sanitary, lighting and heating arrangements are up to date; the recruit is comfortably clothed, and proper laundry and ablution arrangements exist for his benefit.

The second point stressed was the need of sound sleep. The physiology of sleep need not be discussed here except to emphasize that during sleep the metabolic processes are working at their best. It would therefore appear that a great deal of body building takes place during this period. It is the aim of the depot to provide the recruits with long periods of quiet rest in bed. The barracks are situated in a quiet outskirt of Canterbury away from outside noises. The recruits go to bed at 10 p.m. and reveille is at 6.30 a.m. Thus securing a period of eight and a half hours in bed. When a recruit arrives, no matter the time of day or night, he first of all gets a good hot bath in which he may soak. This is followed by new dry and warm clothes and a first class hot meal, and then to bed early.

On the arrival of the recruit at the depot, three of our cardinal principles are put into action right away, but sleep is at this stage the most needed. A satisfied appetite and a comfortable and warm bed in a quiet room tend to secure this.

The day following his arrival the recruit is examined by the officer in medical charge, who forwards his recommendations for dealing with the defects he has found to the Commandant, who passes them on to the officer in charge of physical training for his guidance. This brings us to the third cardinal principle, hard work. Now this hard work really means that while doing his physical exercises the recruit is urged to put the whole of his mind and body into his work. Forget everything else and concentrate. The secret of body-building is the repetition of progressive exercises over a period of time. What the progression will be and what the period of time will be depend chiefly on the state of the recruit when he arrives. It is sometimes necessary in extreme cases involving great malnutrition to begin by putting him for a week or longer under the gardener. Here he does simple jobs which keep him in the open air, and this with good food and plenty of sleep fits him for training.

The exercises adopted at the depot are the early tables of the Physical Training Tables with Apparatus for Recruits and Boys of the Army. These answer the purpose extremely well. In addition, remedial exercises have been drawn up by the officer in charge of physical training. These are practised with the object of remedying the physical defects previously noted. The exercises are planned so as to make the muscles supple in the first place and later to strengthen them. The various muscle groups are taken in rotation and progressively exercised according to the advancement made by the recruit.

One thing that has emerged from the work here is that the building up of bodily strength cannot be effected so long as the chest expansion remains below the standard for height and weight; and whenever the chest is well developed the physical fitness of the recruit is assured provided no active disease is present. He may not be up to the Army standard as regards weight, but nevertheless he is or will become a fit man. It is the cases that remain below the average maximum chest measurement for height and age that require special attention. If no active disease is found then they must have remedial exercises, the aim of which is to make the chest supple and ensure its expansion. Unless this is done we cannot hope to reach a satisfactory result.

There is much talk about diet these days but the importance of getting rid of the end-products of metabolism is not sufficiently stressed. This is not the place to go into the physiology of the excretory apparatus; but a study of it will not only show the systems by which the various end-products are eliminated and the methods employed to achieve this result but will also demonstrate the pathological effects of improper functioning.

Take as example the skin. It is now recognized to be a vital structure with an internal as well as an external secretion and not merely an integument possessing glands and appendages for protection of the body. The skin of an undersized recruit looks for all the world like a plant which has been grown in the dark. It hangs loosely on the body, lacks pigment, is "spotty" and is sometimes greasy with a disagreeable odour, and sometimes it is dry. After a little exertion it perspires freely and copiously. As a result of training, stripped of as much clothing as possible, and in the sunshine and moving fresh air the skin takes on a healthy brown colour with a firm and smooth texture. There is no excess of grease, and no disagreeable odour. On exertion the skin perspires in an amount proportionate to the work done and the surrounding temperature. The skin works in close relation to the nervous system and to the endocrine glands and its proper functioning has a profound influence upon the production of vitamin D. The reaction of the skin to sunlight and air changes of temperature has a stimulating effect on the sympathetic

nervous system and on the endocrine glands, particularly the pituitary thyro-adrenal relation. The proper functioning of the skin results from the physical training given to the recruit.

The undersized recruit will generally show while at rest a pulse of above 80 beats a minute and a respiration rate of 18 per minute. After very moderate exertion the pulse will rise rapidly to 120 per minute and the respirations reach 27 to 30. In the trained soldier the average resting pulse-rate is below 70 and respirations 18 to 20 per minute and during the same exertion his pulse-rate will rise to under 80 and his respirations to 22. After this amount of exercise the time taken to return to the normal resting pulse is much less in the case of the trained soldier than in the recruit. In the former the normal pulse-rate returns within the first ten seconds, in the latter not until after forty-five seconds rest. The normal rate of respiration is reached in the former case in thirty seconds and in the latter after two minutes. The reason for this difference has not been explained satisfactorily, but it would appear to be due to the results of physical training. Amongst them may be mentioned an increase in the size of each alveolar space in the lung following on increased development and hence more efficient lung expansion. This enables the cardiovascular system to function at a higher rate of efficiency. The proper functioning of the diaphragm by increasing the vacuum in the thorax during inspiration hastens the return of the venous blood to the right side of the heart. But such explanations are not entirely satisfactory and require the further addition of a fact and an inference. It has been observed that the percentage hæmoglobin content of the corpuscles in the undersized recruit is generally 90 per cent or less. In the trained man the percentage is 100 per cent. The increase of hæmoglobin is acquired without the administration of any iron or other drug.

The inference from observations is that in the case of these recruits the total volume of the blood is increased in the same manner as there is growth of any other tissue, for example, the muscular tissue. Rowntree, Brown and Worth confirm this in "Volume of the Blood and Plasma in Health and Disease", published by Saunders, 1929. If this hypothesis is granted and taken in conjunction with other facts, it will be readily grasped why there is no necessity for violent increase in the rate of the pulse and respirations when a little extra work is thrust upon the trained individual. The larger volume of blood, the full complement of hæmoglobin, and other constituents of the blood and especially the lymph, lead not only to the efficient, easy, and rapid removal of waste products after work is performed by the body, but to there being available a larger volume of oxygen and the products of digestion for use by the tissues when doing work.

The massaging and beneficial effects of exercise on the digestive

system are well known and need only to be mentioned. The development of the nervous system is also marked, especially of the peripheral nerves, the cerebellum and voluntary control of the muscles from the cerebrum. Physical training leads directly to better functioning and often the development of co-ordination of movement and a sense of voluntary muscular control. The stimulation of the sympathetic nervous system through the skin has already been referred to, but the nervous system is also receiving benefit due to stimulation from healthy internal organs. The result of this gain of mental control over the body is the development of self-confidence, self-reliance, and self-control.

Closely allied to physical training comes recreational training which is the cardinal principle next in order of importance. This, of course, when properly carried out has many of the advantages of physical training, and it is a method of maintaining fitness in a person who has already become physically fit. Recreational exercise brings out the team spirit and in order to teach this spirit some proficiency at the game must be taught. A great many of our recruits have little or no idea of how to play games. Many play their first game of football when they come to our depot, very few of them have any accurate knowledge of how a flat race should be run. They know all about "playing the game" and "playing for the side" and at bottom the majority of them are stout-hearted lads. They lack the knowledge of how to play most games. Their instructors are patient and encouraging and it is marvellous how soon a certain amount of proficiency is acquired. Athletics and boxing are taught in addition to ball games, e.g. football and cricket.

Indoor recreation is also provided. There is a library and a well-run canteen, and cinema entertainments and dances are arranged.

We should not, however, give a complete survey of the work done if no mention were made of educational work and spiritual welfare. The latter is carried out by the chaplains of the various denominations, who visit the depot once a week. With regard to education it is the aim of the depot to see that when a recruit remains long enough he shall have his Third Class Army Certificate of Education. This is not very high from the point of view of a civilian standard, but it must be remembered that few of these recruits were efficient at school and that they had forgotten most of what they had been taught.

The next cardinal principle adopted for dealing with the undersized recruit is good food. When the depot first began the slogan was "Give them good food and plenty of it" and this was done to a generous degree, but soon it became evident that "Good food and plenty of it" was not the panacea for all ills as was expected. It was noted that during the first two weeks the increase of weight is generally remarkable, but that later with the same amount of food eaten there is a slowing down of the rate of

increase in weight. This may be quite marked and last for months until suddenly something happens and the weight shoots up. The first increase in weight has been attributed to an increase in appetite following on the environmental change by the recruits coming to the depot. This is similar to the benefit experienced as a result of a month spent by a town-dweller beside the sea in summer. There is usually an increase in adipose tissue and when once this increase is satisfied further increase in weight depends on development. This may be of two kinds, viz. (*a*) normal increase with increasing age, and (*b*) increase due to the result of work or in this case physical training. The former is not of much note at our depot on account of the shortness of the stay there. The latter was discussed when physical training was under review. At first the increase in weight may be very marked. It is generally most marked in a recruit who has had a certain amount of physical development but has fallen on bad times and food has not been too plentiful. The recruit who has suffered from severe malnutrition most of his life does not respond so quickly or dramatically. This is probably because he cannot make sufficient use of the food provided. He builds up more slowly and adipose tissue is not of course put on to any marked degree until the requirements of the other systems have been satisfied and as often as not he may never put on any very great amount of fat while at the depot. The food supplied to the recruits is the ordinary Army ration with milk and fruit added. A special allowance is available to meet these additions. Specimen diet sheets are given later. Four meals are served each day, also early morning tea and a snack at 10.30 a.m. consisting of milk and fruit, with soup instead of milk in winter. In winter milk is served instead of tea at the afternoon meal. There is abundance for all and those who desire more of any dish can have it. The meals are varied from day to day, and from week to week, and according to the time of year. The variation is arranged so that each vitamin is given in sufficient quantity, and vegetables are available either as greens or as roots each day. When fresh fruit and vegetables cannot be obtained, the dried article is supplied. Tinned foods, except tomatoes, and pork and beans are reserved for emergencies. Although not shown in the diet sheet, fresh lettuce, raddish, etc., are supplied from our own garden during the season, as also are young carrots, spring onions, beetroot, marrow, etc. Butter, vitaminized margarine, fresh eggs and fresh milk are given in good quantities. Fresh fish is provided for supper once or twice a week. Meat, liver and bacon (but rarely fresh pork or kidneys) are served. The sausages are made in the cookhouse, and so are the cakes for tea. The custard is made with fresh milk and no water is added. All patent or proprietary foods are omitted and dependence is placed on the preparation in the cookhouse of wholesome food from fresh supplies.

The principles followed for the provision of a suitable diet are those which ensure an "optimum" rather than a "safe" diet, and certainly not a "minimal."

Assuming that an adult requires 120 grammes a day of protein, we shall have to provide at least one kilogram of food each day for an all-round mixed optimum diet. Allowing 250 grammes of this kilogram to be taken up as water, roughage, and other items that have no calorie value, there is left 500 grammes for carbohydrate and fat. In an optimum diet the fat will be of a normal amount, and it will be safe to assume that these 500 grammes, with the 120 grammes of protein, will ensure some 3,000 calories. This diet is of very modest size, but it serves to show that if a diet contains sufficient protein the fat and carbohydrate intake will be sufficient. The proportion of fat to carbohydrate is largely a matter of taste, depending on the number of calories required. We must, however, qualify this by saying that the intake of fats must be sufficient to meet the requirements of the fat-soluble vitamins. Again, the protein intake should be at least fifty per cent first-class protein. As regards the minerals, if iron is suitably provided, so will be copper, manganese, and cobalt. Also if the calcium intake is adequate, so will be that of phosphorus and magnesium. For an optimum diet the daily intake of iron should be 15 milligrams a day in an easily assimilable form, for example, in vegetables, cereals, liver, heart, egg yolk, and so on.

The requirements of calcium are between 1 and 2 grammes per day. This is obtained chiefly from dairy produce, green leaves, vegetables, pulses, egg yolk, etc. Most minerals can be secured by the intake of wholemeal bread. Lastly we come to the vitamins. The problem of their provision has been simplified. Wholemeal, cereal and green leaves secure adequate intake of ascorbic acid, aneurin chloride, carotene and vitamin E; dairy produce in abundance and animal protein means adequate flavin and vitamin B_2, some vitamin A, and in summer vitamin D. In winter vitamin D needs to be specially added to the diet, and to a lesser extent so does vitamin A. This is chiefly due to the manner of feeding cattle during winter months, especially during January, February and March, in this country. The scarcity of these vitamins is also due to an inadequate supply of sunshine during winter.

It may be contended that the diet is too liberal and that there is probably a greal deal of waste. This is not so. Waste means either bad cooking, faulty serving, or failure to make the most of the viands provided, or the superabundant preparation of one dish. All these points of economy are carefully watched, as for example, bread is provided in half slices on the table and butter is served in pats. All bread not used is available for puddings and other dishes. It does not go to the swill-tub as in former days. All fat is rendered down to dripping and used for a host

of purposes in the kitchen. It has not been found necessary to purchase any dripping from the canteen. This makes deep frying economical. Bones, especially long bones are pounded down and used for making rich soups. The marrow with its nucleo-protein is thus made available. Many other examples could be provided of good housekeeping. Food in abundance but in great variety is the aim of our messing officer.

The objection might be taken that certain desirable articles of diet are omitted from the menu. This is true. Alternative dishes at meals, certain vegetables and fish cannot for economic reasons be provided, and other articles, e.g. sweetbreads, brain cutlets, etc., are not provided because they are not eaten by these recruits. The same objection applies to the omission of certain well-known dishes, e.g. cooked cheese and savoury dishes. An unusual flavour, no matter how delectable the dish may be, is sufficient to condemn it.

It is estimated that each man is supplied with some 4,000 to 5,500 calories a day but observation of the actual food eaten by men over a period brings the calorie intake down to anything from 3,500 to 5,000 calories a day, after allowing for preparation, cooking, and other wastage. It was observed that some recruits ate much more than others, but that the actual intake of food does not bear close relation either to the general size of the recruit or to his requirements for reaching standard weight, nor is the total consumption of food proportional to the weight gained. Again the amount of food consumed from day to day varies greatly in the individual, apparently for no particular reason. These differences may be accounted for by a voracious appetite, but a more likely explanation is that the appetite urges the satisfaction of bodily requirements but the digestive system, as a result of poor physical development and malnutrition, cannot make full use of the food eaten. This failure of digestion may also help to explain why some recruits reaching a certain weight pause for a while and then without any very obvious reason begin to add to their weight again, as though they waited for a development in their digestive system and metabolic processes. There is nothing in the world so much dogmatized about as food, and scientific knowledge has not yet solved the problem of what to eat nor in what manner, if at all, it should be prepared for eating. But we know that abundance and as large a variety as possible should be provided for the undersized recruit in the hope that as he progresses he will absorb sufficient both for growth and development.

The last of the cardinal principles is contentment. Worry and mental distress can do more harm to these lads than lack of food or nourishment. There was a lad who came from the north of Ireland. He stated that although his father and mother were alive, he had been brought up by his

grandmother and she had never received any help from his parents. To bring in a little money for his grandmother at the age of 12 he used to sell fish in the streets. He was never in regular employment. When he was 18 the grandmother died, and he, hoping to better himself, joined the Army and was sent to our depot as an undersized recruit. He was 5 feet 2 inches in height, 97 pounds in weight, and his maximum chest measurement was 31½ inches. There was no evidence of active disease on examination. For a time he did well and appeared to be settling down to his work, then suddenly he became morose and kept to himself a great deal. His work was neglected and in consequence he began to get into trouble. His weight, which had increased considerably, fell right back and he himself was in a state bordering on neurasthenia. He came sick daily, saying he did not feel fit for the Army and so on. He did nothing but mope around. One day he was asked what was the matter with him, and he said he was having trouble with his parents. He produced letters from his father complaining bitterly of his having joined the Army instead of remaining at home to support his parents. Another letter upbraided him for being unfilial and ungrateful to his parents who had brought him into the world. The letters also stated that the priest thought he was neglecting his parents and that he should send money home for their support. The lad said that he did not want to go home and have his earnings taken by a father who had shown no interest in him and who had treated his grandmother badly, but that the letters worried him because he wanted to do what was "right." He was advised to sit down and write to his father that he was not coming home because he was quite happy where he was, that he could not at present afford to support them, and that in any case the Army authorities had no intention of releasing him from service. These letters had the desired effect and the lad immediately became happy and contented. He improved in every way and ended up after three months 114 pounds in weight and 34 inches around the chest, and became the leader of his squad and was sent to his regiment as a first-class recruit. This story is sufficient to show the importance of a contented mind in these recruits.

The Result.

The standards to which it is desirable recruits should reach on enlistment are those laid down in Table I. In addition they must be free from disease likely to interfere with their future efficiency. Minor maladies such as varicose veins, chronic tonsillitis, dental deficiency, defective vision and so on are no bar to enlistment, provided the recruit is willing to be treated at his depot.

Table II shows in tabular form the age and height of all undersized recruits who entered the depot from May 19, 1937, to May 18, 1938. In addition, the numbers who were posted to their Regimental Depots, who were discharged, and the average time spent by the recruits at the R.P.D.D. are shown.

Table III gives further particulars in regard to weight and maximum chest measurement at the time of their admission. The figures in italics show those who after training failed to reach a sufficient standard for

(*Continued on p.* 20.)

Table I.—Comparative Tables Used in Recruiting for Age, Height, and Maximum Chest Measurement.

Age	Height	Weight	Chest-girth when fully expanded
	Inches	Lb.	Inches
18	62 and under 65	112	33
	65 ,, 68	115	33½
	68 ,, 72	118	34
	72 and upwards	122	34½
19	62½ and under 65	114	33½
	65 ,, 68	117	34
	68 ,, 70	120	34½
	70 ,, 72	124	35
	72 and upwards	128	35½
20	62½ and under 65	115	33½
	65 ,, 68	120	34
	68 ,, 70	123	34½
	70 ,, 72	126	35
	72 and upwards	130	35½
21	62½ and under 65	118	33½
	65 ,, 68	121	34½
	68 ,, 70	124	35
	70 ,, 72	127	35½
	72 and upwards	132	36
22 and over	62½ and under 65	120	34
	65 ,, 68	123	34½
	68 ,, 70	126	35
	70 ,, 72	130	35½
	72 and upwards	133	36

The range of chest expansion in all cases will not be less than 2 inches.

TABLE II.—UNDERSIZED RECRUITS, 1937-1938. THE RESULTS OF TRAINING AND THE AVERAGE TIME SPENT AT THE R.P.D.D.

Age, yrs.	Height, in.	Total arrivals	Posted Regt. depots	Discharges					Average time at depot
				Not on medical grounds	Without training	Diseases during training	Sub-standard after training	Total	
									Mths.
17	Var.	6	5	—	—	—	1	1	3·00
18	60	7	5	—	2	—	—	2	2·70
	61	51	42	1	2	1	5	9	2·32
	62	80	70	1	2	1	6	10	2·70
	63	100	85	6	1	3	5	15	1·58
	64	126	113	4	2	4	3	13	2·50
	65	68	60	3	2	—	3	8	2·80
	66	54	50	2	—	—	2	4	2·03
	67	35	33	2	—	—	—	2	2·00
	Over 67	22	20	1	—	1	—	2	1·40
19	60	2	1	—	—	—	1	1	1·50
	61	23	22	—	—	—	1	1	2·27
	62	17	16	—	—	—	1	1	2·18
	63	27	23	—	1	2	1	4	2·61
	64	29	24	1	—	2	2	5	2·41
	65	8	8	—	—	—	—	—	1·94
	66	12	11	—	—	1	—	1	1·56
	67	2	1	—	—	1	—	1	2·16
	Over 67	6	6	—	—	—	—	—	1·60
20	61	5	2	—	2	—	1	3	1·25
	62	16	12	—	1	—	3	4	2·46
	64	17	15	—	1	—	1	2	2·20
	65	6	5	—	1	—	—	1	2·60
	66	14	13	—	1	—	—	1	1·20
	68	2	2	—	—	—	—	—	2·20
21	61	3	3	—	—	—	—	—	1·66
	62	7	6	—	—	—	1	1	2·41
	Over 62	25	19	2	2	—	2	6	2·10
Over 21	Under 65	50	45	3	—	—	2	5	2·25
	Over 64	14	12	—	—	1	1	2	2·54
Total	.. ..	834	729	26	20	17	42	105	2·25

Percentage number of arrivals who go to Regtl. Depots = 87·41 per cent.
Percentage number of arrivals who are discharged = 12·58 per cent.
Percentage number of arrivals who are discharged on medical grounds = 7·00 per cent.

TABLE III.—UNDERSIZED RECRUITS.

Explanatory Notes.

Note 1.—Accepted recruits are arranged according to their age, height, weight and maximum chest measurement on arrival.

Note 2.—Rejected recruits in whom no disease was discovered are shown in *italics* similarly arranged.

TABLE III.—UNDERSIZED RECRUITS. AGE 18 YEARS. 1937-1938.

	Height	Under 62 inches						62 inches						63 inches						64 inches						65 inches						66 inches						Over 66 inches					
	Chest	Under	31½ in.	32 in.	32½ in.	33 in.	Over	Under	31½ in.	32 in.	32½ in.	33 in.	Over	Under	31½ in.	32 in.	32½ in.	33 in.	Over	Under	31½ in.	32 in.	32½ in.	33 in.	Over	Under	32 in.	32½ in.	33 in.	33½ in.	Over	Under	32 in.	32½ in.	33 in.	33½ in.	Over	Under	32 in.	32½ in.	33 in.	33½ in.	Over
Weight in pounds	Below 100	2	1	2	1 *1*	*2*		*2*		2 *2*	1 *1*	1	1	2	2 *1*	1	1 *1*	2	*1*	1 *1*		3	4 *1*		1 *1*	2			1			*1*		*1*									
	100 to 103			5	2 *1*	1	3 *1*			4	5	5	5 *1*	2	1 *1*	5	2	4	4	1	5	6	7	8	2	3	2		3 *2*	2	1	1	1	2	2			1	2	1			
	104 to 107			2	4	4	6	1		4	3	7	14	1	2	6	6 *1*	7	18	1		3	8	15	18	1	3	5	3	4	2	1	4	3	6	3	3	4	3		1	1	
	108 to 112				1	3	8			1	1	5	8	1	1	3	3	5	6			2	6	9	13	1	2		2 *1*	4	4	2	2	4	5	5	2	8	2	8	2		
	Over 112						2						1														1	1	1	1	1		1	1	1	1		3	4	6	4	1	2

TABLE III—*cont.*—UNDERSIZED RECRUITS. AGE 19 YEARS. 1937-1938.

	Height	Under 62 inches						62 inches						63 inches						64 inches						Over 64 inches					
	Chest	Under	31½ in.	32 in.	32½ in.	33 in.	Over	Under	31½ in.	32 in.	32½ in.	33 in.	Over	Under	31½ in.	32 in.	32½ in.	33 in.	Over	Under	32 in.	32½ in.	33 in.	33½ in.	Over	Under	32 in.	32½ in.	33 in.	33½ in.	Over
Weight in pounds	Below 100	1	*1*		1					*1*			1					1		1	1			1	*1*			1			
	100 to 103		*1*	1		1	1			1	1	1	2				*1*	3	3				2	*1*	2	1			4		
	104 to 107				1	1	7					1	2						4		1		3		5	1	1	2			
	108 to 112						1				1	1	1				2	1	3		1	1		2	4			1	1	1	3
	Over 112					1	2												1									1	6	1	2

Table III—*cont.*—Undersized Recruits. Age 20 Years. 1937-1938.

	Height	62 to 63 inches						Over 63 inches					
	Chest	Under	32½ in.	33 in.	33½ in.	34 in.	Over	Under	32½ in.	33 in.	33½ in.	34 in.	Over
Weight in pounds	Below 100	*1*			2								
	100 to 103	*1*	*1*		1	1					1	1	
	104 to 107		*1*	1	1	3		3		2 *1*	5	2	1
	108 to 112		1				2		3	4	5	4	
	Over 112							1		2			

Table III—*cont.*—Undersized Recruits. Age 21 Years. 1937-1938.

	Height	Under 63 inches						Over 63 inches					
	Chest	Under	32½ in.	33 in.	33½ in.	34 in.	Over	Under	32½ in.	33 in.	33½ in.	34 in.	Over
Weight in pounds	Below 100	*1*						1					
	100 to 103					1 *1*	1	1		1	1		
	104 to 107		1	1					2	2	3		
	108 to 112				2		2			1	2	1	1 *1*
	Over 112						1		1	2	1		

Table III—*cont.*—Undersized Recruits. Age over 21 Years. 1937-1938.

	Height	Under 63 inches						Over 63 inches					
	Chest	Under	32½ in.	33 in.	33½ in.	34 in.	Over	Under	32½ in.	33 in.	33½ in.	34 in.	Over
Weight in pounds	Below 100							1	*1*				
	100 to 103				1	1	1	1 *1*	1	3		1	
	104 to 107	*1*	1		1	2	1		1	2	3		
	108 to 112					2	3	2		1	5	3	4
	Over 112						1		2	4		1	5

retention in the Service, although no disease was apparent, and were in consequence discharged. Table IV shows further details of these cases.

A study of Table II reveals some remarkable facts. Of a total of 834 undersized recruits who arrived at the Depot, no less than 729 were passed to Regimental Depots. This represents roughly a battalion of infantry. This result is the more remarkable when it is observed that these recruits, formerly rejected in recruiting offices, become sufficiently physically fit to be trained as soldiers after a stay at the R.P.D.D. lasting on an average of nine weeks.

Again, of the 105 men discharged, a quarter of them went for reasons other than medical defects. Another fifth went on medical grounds without training; these were men who suffered from severe disability or disease. They were not considered suitable for service of any kind. This leaves 59 men who were rejected on medical grounds after training. An examination of this group shows that 17 of them had definite active disease or disability debarring them from service, while 42 failed to reach a standard sufficiently high to enable them to be passed to their depots. This represents a failure of 5 per cent on the total admissions.

These failures are shown in italics according to age, height and chest measurements in Table III. Most of the men are found at a given age to be below 104 pounds in weight, 64 inches in height, and 33 inches in maximum chest measurement. Many more men in this category pass out fit than fail, so reasons for failure must be sought outside these tables. Table IV gives some further particulars of these cases, and a study shows that in certain cases of severe malnutrition the time available to repair the damage done is quite insufficient. The ordinary time limit at this Depot is put down at three months, but often an extra month or two may be added in an effort to save men for the Service. The question of age has to be considered. It would be very easy to classify these lads as below 18 years of age and leave it at that. But after more than a year's experience of this work I have seen so many mistakes in this respect that I accept no age except on proof. Many of the lads who nine people out of ten would say were but 15 or 16 years of age would produce unmistakable evidence of their birth having taken place in the year 1920. Other lads, well developed and muscularly firm and set, with sometimes hairy chests, undoubtedly would be thought by the same nine or ten people to be nineteen years of age, but they are often only seventeen, and may be claimed out of the Service by their parents on that account. There would appear to be considerable difference between chronological and physiological age; it would be interesting to discover the factors that are responsible for the differences.

Many of this group may have some disease which would account for their being failures, but this is doubtful as the mere factor of size did not

TABLE IV.—FURTHER DETAILS OF FORTY-TWO RECRUITS WHO FAILED TO REACH THE PHYSICAL STANDARDS AFTER TRAINING.

No.	Age, years	Height, in.	Weight, lb.	Chest, in.	Remarks
1	17	64	102	33	An Anglo-Indian. No disease found
2	18	61	96	33	Reached 101 lb. after four months. Was muscularly weak
3	18	61	98	33	Poor physique. Reached 102 lb. in three months
4	18	61	99	32½	Reached 99½ lb. in three months. Had chronic infection tonsils
5	18	61	101	34½	No disease found. Reached 106½ lb. in three months
6	18	61	102	32½	No disease found. Reached 106 lb. in five months
7	18	62	93½	30½	Reached 101 lb. in weight and 32 in. chest in four months. A "bantam"
8	18	62	94	32½	Severe malnutrition. Reached 99 lb. in three months
9	18	62	96	32	Reached 105 lb. in five months. Very doubtful if 18 years old
10	18	62	99	32	Spent most of his time in hospital, severe fracture radius and ulna. Weight after ten months 102½ lb.
11	18	62	95	31	Reached 102 lb. in three months. Of doubtful age
12	18	62	103	34	Reached 105 lb. in four months. No disease found
13	18	63	94	31½	After five months max. chest measure was 33½ in., and weight was 106 lb. No disease was discovered
14	18	63	96	32½	Reached 100 lb. in five months. Nil abnormal discovered
15	18	63	98	34	Reached 103 lb. in 2½ months. Very fit. So-called "bantam"
16	18	63	100½	31½	No disease found. Reached 105 lb. in three months
17	18	63	104	32	Very poor physique. Reached 107 lb. in three months
18	18	64	97	31	Malnutrition marked. Reached 102 lb. in three months
19	18	64	98	33½	Was under E.N.T. specialist two months with mastoiditis. Made 100½ lb.
20	18	64	99	32½	Made 103½ lb. and 34 in. chest in three months. No disease discovered. ? Age
21	18	65	102	33	Made 103 lb. in three months. Weakling and doubtful age
22	18	65	108	33	No gain after two months. Disease probably present but not found
23	18	66	96½	32½	Severe malnutrition
24	18	66	99	31	Made 108 lb. and 32½ in. chest in five months. Insufficient time to develop at depot
25	19	60	103	31½	Made 108 lb. and 32 in. chest in five months. Appeared fit
25	19	61	93	31½	Reached 96 lb. and 32 in. chest in two and a half months. Doubtful age
27	19	62	94	32½	Reached 98 lb. in four months. Severe malnutrition
28	19	63	101	32½	Made 103½ lb. in four months. Doubtful age
29	19	64	102	33	No active disease found although suspected
30	19	64	98	34½	Made 104½ lb. and 35 in. chest in three months. Fit
31	20	61	107	32½	Made 109 lb. in five months. Poor muscular development
32	20	62	102	32½	Made 107 lb., then dropped to 101 lb. in three and a half months
33	20	63	94	32½	Failed to reach 100 lb. in three months. Severe malnutrition
34	20	63	100	32	Required four months to reach 106 lb. and 32½ in. chest
35	20	64	104	33	Made 107 lb. in five months. No disease found
36	21	62	97	32	Reached 105 lb. and 32 in. chest in four months. Severe malnutrition
37	25	66	111	34½	In three months made 117 lb. and 36 in. chest. A dullard
38	21	64	98	32½	Made 104½ lb. and 33 in. chest in five months. A small-sized man, medically fit.
39	21	65	100	31½	Made 106½ lb. in five months, chest 32 in. maximum expansion. Malnutrition
40	22	61	101	34	Reached 106 lb. in five months. No abnormality found
41	22	62	97	32	Only reached 104 lb. and 34 in. chest in five months. Fit
42	19	65	103	33	Reached 107½ lb. and 34 in. chest in three months. Appeared fit

conceal the fact that many of the lads were as physically fit as their larger brother recruits and that careful examination did not reveal the existence of any disease, even the blood sedimentation test gave no pointer to a deviation from health. Such examples in Table IV would be those recruits marked as medically sound, and here, besides the question of age, the question of the stock they come from makes interesting investigation. They come from small stock in most cases, but in some families one parent is large and the other small; while again both parents may have been well grown and well developed, and he the only small one in the family, suggesting a reversion to an earlier type.

The problem is exceedingly complicated as similar histories may be given by the well-grown recruit. These lads usually make excellent gymnasts and show wonderful muscular control, suppleness of movement and for their size good muscular development.

The further progress of the 729 recruits who were passed on to their Regimental Depots is interesting. After training 706 went to their battalions. The wastage then was 23 or 3·15 per cent. of those dispatched from the R.P.D.D. Of the discharges only four were discharged on grounds of ill-health, or expressed as a percentage 0·54 per cent. Of these four, one refused an operation for inguinal hernia, the second was a case of flat feet, the third suffered from defective vision, while the last had an undescended testicle with hernia. It is interesting to note that no recruit was discharged on account of defects or diseases arising from their lack of nourishment and under-development before enlistment.

The acquirement of physical fitness in the undersized recruit as the result of the application of the six cardinal principles already discussed can be demonstrated best by the examination of the progress made in increasing weight and chest measurement. There would appear to be four main ways in which this progress is manifested, viz. :—

Group A: Rapid and continuous increase.
Group B: Steady and continuous progress.
Group C: Poor progress at R.P.D.D. Rapid at Regimental Depot.
Group D: Poor progress at R.P.D.D. and at Regimental Depot.

Table V and the graph have been compiled to illustrate these groups. Each type is an actual case selected to represent his group. For purposes of comparison these types have been selected as being as near as possible of the same age, height, weight, and maximum chest measurement. The age that was chosen was 18 years, and the height 63 to 65 inches. The tallest represents Group D. There are infinite variations within each group.

TABLE V.—UNDERSIZED RECRUITS. THE INCREASE IN WEIGHT.

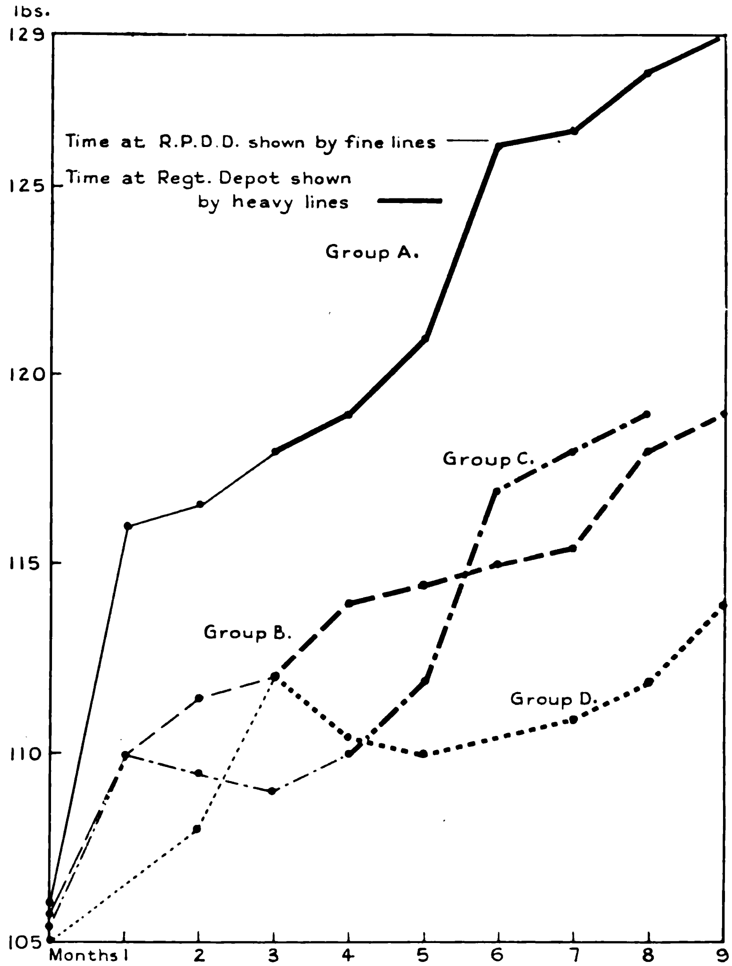
Month	On joining	1st	2nd	3rd	4th	5th	6th	7th	8th	9th
Group A. Rapid and continuous increase.										
Weight, lb.	105	116	116½	118	119	121	126	126½	128	128¾
Max. chest meas.	32½ in.	33 in.	33½ in.	33½ in.	34 in.	34 in.	34 in.	34½ in.	34½ in.	34½ in.
Group B. Steady and continuous progress.										
Weight, lb.	106	110	111½	112	114	114½	115	115½	118	119
Max. chest meas.	32½ in.	33 in.	33 in.	33 in.	33½ in.	33½ in.	33½ in.	34 in.	34 in.	34 in.
Group C. Poor progress at R.P.D.D. Rapid at Regt. Depot.										
Weight, lb.	106	110	109½	109	110	112	117	118	119	—
Max. chest meas.	32½ in.	33 in.	33 in.	33 in.	33 in.	33½ in.	34½ in.	34½ in.	34½ in.	—
Group D. Poor progress at R.P.D.D. and at Regt. Depot.										
Weight, lb.	105	—	108	112	110½	110	—	111	112	114
Max. chest meas.	32½ in.	—	32½ in.	33 in.	33 in.	33 in.	—	34 in.	35 in.	35 in.

Group B is the method by which the majority of our recruits advance. There is an initial increase of 4 to 6 pounds in the first month and this is followed by a gradual increase of ½ to 2 pounds a month for about five to six months and then a more rapid increase for a short period.

In Group A the increase in weight proceeds by the same kind of progression, but a larger amount of weight is put on within the same period of time. In the type case it was no less than 24 pounds. The initial rise was 10 pounds in the first month and the period of slow progression is shorter before the second increase.

Type case illustrating Group C shows a different picture; the initial increase was 4 pounds in the first month. But although he remained at the Depot another three months his weight did not increase. During the first two months at the Regimental Depot he put on seven pounds and eventually left there weighing 119 pounds after a total service of eight months. Cases of this type are not very numerous.

The Group D type are still fewer in number and the records available do not show what happens to these men's weight after they join their battalion from their Regimental Depot, but from the results of the experiment with the first thirty men it would appear that this group can be subdivided into those who eventually make weight in their battalions and those who do not.



THE GRAPH.

Table VI shows the causes for rejection in undersized recruits who were discovered to have definite lesions. It was noticed that disease may attack any recruit irrespective of his build. Cases showing tubercular infection are not confined to those who displayed the most marked malnutrition. In fact, they may be discovered in those who appear the most healthy. Two cases of tubercle of the lung were diagnosed by X-ray examination and were of the pre-clinical type. The cases of tubercular infection of other organs were one of tubercular peritonitis and another of tuberculosis of the kidney.

TABLE VI.—CAUSES OF REJECTION. UNDERSIZED RECRUITS WITH ACTIVE DISEASE.

Cause of rejection	Without training	After training
Under height	1	—
Insufficient weight	5	—
Impaired constitution and debility	—	1
Affections of bones, joints and muscles :—		
Pes cavus	1	—
Hallux rigidus	1	—
Hallux valgus	1	—
Other defects lower extremities	1	1
Diseases of the nervous system :—		
Epilepsy	2	—
Other diseases of the nervous system ..	1	—
Affections of the ear :—		
Chronic otitis media	1	1
Diseases of the respiratory system :—		
Nasal obstruction	—	1
Tubercle of the lung	2	1
Bronchitis and fibrosis	1	4
Other diseases of the respiratory system ..	1	1
Diseases of the circulatory system :—		
Valvular disease of the heart	—	2
Other diseases of the circulatory system ..	—	2
Tuberculosis (other than that of the lungs) ..	1	1
Other general diseases	1	2
Total ..	20	17

The five cases of insufficient weight who were discharged without training were all below 97 pounds in weight, one being 89 pounds. They usually also suffered from malnutrition and were, moreover, suspected of being below the age of 18 years.

The cases of valvular disease of the heart were interesting because of the interval between the rheumatic fever and the onset of the cardiac condition. It was three years almost to the month. Neither case had tachycardia and early symptoms of precardial distress led to the discovery of the murmur. The murmurs were extremely difficult to hear and were mid-diastolic in time and located over the mitral area. No recruits were discovered having evidence of helminths.

The Result.

The standards to which it is desirable recruits should reach on enlistment are those laid down in Table I. In addition they must be free from disease likely to interfere with their future efficiency. Minor maladies such as varicose veins, chronic tonsillitis, dental deficiency, defective vision and so on are no bar to enlistment, provided the recruit is willing to be treated at his depot.

Table II shows in tabular form the age and height of all undersized recruits who entered the depot from May 19, 1937, to May 18, 1938. In addition, the numbers who were posted to their Regimental Depots, who were discharged, and the average time spent by the recruits at the R.P.D.D. are shown.

Table III gives further particulars in regard to weight and maximum chest measurement at the time of their admission. The figures in italics show those who after training failed to reach a sufficient standard for

(*Continued on p.* 20.)

Table I.—Comparative Tables Used in Recruiting for Age, Height, and Maximum Chest Measurement.

Age	Height	Weight	Chest-girth when fully expanded
	Inches	Lb.	Inches
18	62 and under 65	112	33
	65 ,, 68	115	33½
	68 ,, 72	118	34
	72 and upwards	122	34½
19	62½ and under 65	114	33½
	65 ,, 68	117	34
	68 ,, 70	120	34½
	70 ,, 72	124	35
	72 and upwards	128	35½
20	62½ and under 65	115	33½
	65 ,, 68	120	34
	68 ,, 70	123	34½
	70 ,, 72	126	35
	72 and upwards	130	35½
21	62½ and under 65	118	33½
	65 ,, 68	121	34½
	68 ,, 70	124	35
	70 ,, 72	127	35½
	72 and upwards	132	36
22 and over	62½ and under 65	120	34
	65 ,, 68	123	34½
	68 ,, 70	126	35
	70 ,, 72	130	35½
	72 and upwards	133	36

The range of chest expansion in all cases will not be less than 2 inches.

TABLE II.—UNDERSIZED RECRUITS, 1937-1938. THE RESULTS OF TRAINING AND THE AVERAGE TIME SPENT AT THE R.P.D.D.

Age, yrs.	Height, in.	Total arrivals	Posted Regt. depots	Discharges					Average time at depot
				Not on medical grounds	Without training	Diseases during training	Sub-standard after training	Total	
									Mths.
17	Var.	6	5	—	—	—	1	1	3·00
18	60	7	5	—	2	—	—	2	2·70
	61	51	42	1	2	1	5	9	2·32
	62	80	70	1	2	1	6	10	2·70
	63	100	85	6	1	3	5	15	1·58
	64	126	113	4	2	4	3	13	2·50
	65	68	60	3	2	—	3	8	2·80
	66	54	50	2	—	—	2	4	2·03
	67	35	33	2	—	—	—	2	2·00
	Over 67	22	20	1	—	1	—	2	1·40
19	60	2	1	—	—	—	1	1	1·50
	61	23	22	—	—	—	1	1	2·27
	62	17	16	—	—	—	1	1	2·18
	63	27	23	—	1	2	1	4	2·61
	64	29	24	1	—	2	2	5	2·41
	65	8	8	—	—	—	—	—	1·94
	66	12	11	—	—	1	—	1	1·56
	67	2	1	—	—	1	—	1	2·16
	Over 67	6	6	—	—	—	—	—	1·60
20	61	5	2	—	2	—	1	3	1·25
	62	16	12	—	1	—	3	4	2·46
	64	17	15	—	1	—	1	2	2·20
	65	6	5	—	1	—	—	1	2·60
	66	14	13	—	1	—	—	1	1·20
	68	2	2	—	—	—	—	—	2·20
21	61	3	3	—	—	—	—	—	1·66
	62	7	6	—	—	—	1	1	2·41
	Over 62	25	19	2	2	—	2	6	2·10
Over 21	Under 65	50	45	3	—	—	2	5	2·25
	Over 64	14	12	—	—	1	1	2	2·54
Total	.. ..	834	729	26	20	17	42	105	2·25

Percentage number of arrivals who go to Regtl. Depots = 87·41 per cent.
Percentage number of arrivals who are discharged = 12·58 per cent.
Percentage number of arrivals who are discharged on medical grounds = 7·00 per cent.

TABLE III.—UNDERSIZED RECRUITS.

Explanatory Notes.

Note 1.—Accepted recruits are arranged according to their age, height, weight and maximum chest measurement on arrival.

Note 2.—Rejected recruits in whom no disease was discovered are shown in *italics* similarly arranged.

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TABLE III.—UNDERSIZED RECRUITS. AGE 18 YEARS. 1937-1938.

Height	Under 62 inches						62 inches						63 inches						64 inches						65 inches						66 inches						Over 66 inches					
Chest	Under	31½ in.	32 in.	32½ in.	33 in.	Over	Under	31½ in.	32 in.	32½ in.	33 in.	Over	Under	31½ in.	32 in.	32½ in.	33 in.	Over	Under	31½ in.	32 in.	32½ in.	33 in.	Over	Under	32 in.	32½ in.	33 in.	33½ in.	Over	Under	32 in.	32½ in.	33 in.	33½ in.	Over	Under	32 in.	32½ in.	33 in.	33½ in.	Over
Weight in pounds: Below 100	2	1	2	1 *1*	*2*		*2*		2 *2*	1 *1*	1	1	2	2 *1*	1	1 *1*	2	*1*	1 *1*		3	4 *1*		1 *1*	2			1			*1*		*1*									
100 to 103			5	2 *1*	1	3 *1*			4	5	5	5 *1*	2	1 *1*	5	2	4	4	1	5	6	7	8	2	3	2		3 *2*	2	1	1	1	2	2			1	2	1			
104 to 107			2	4	4	6	1		4	3	7	14	1	2	6	6 *1*	7	18	1		3	8	15	18	1	3	5	3	4	2	1	4	3	6	3	3	4	3		1	1	
108 to 112				1	3	8			1	1	5	8	1	1	3	3	5	6			2	6	9	13	1	2		2 *1*	4	4	2	2	4	5	5	2	8	2	8	2		
Over 112						2						1														1	1	1	1	1		1	1	1	1		3	4	6	4	1	2

TABLE III—*cont.*—UNDERSIZED RECRUITS. AGE 19 YEARS. 1937-1938.

Height	Under 62 inches						62 inches						63 inches						64 inches						Over 64 inches					
Chest	Under	31½ in.	32 in.	32½ in.	33 in.	Over	Under	31½ in.	32 in.	32½ in.	33 in.	Over	Under	31½ in.	32 in.	32½ in.	33 in.	Over	Under	32 in.	32½ in.	33 in.	33½ in.	Over	Under	32 in.	32½ in.	33 in.	33½ in.	Over
Weight in pounds: Below 100	1	*1*		1					*1*			1					1		1	1			1	*1*			1			
100 to 103		*1*	1		1	1			1	1	1	2				*1*	3	3				2	*1*	2	1			4		
104 to 107				1	1	7					1	2						4		1		3		5	1	1	2			
108 to 112						1				1	1	1				2	1	3		1	1		2	4			1	1	1	3
Over 112					1	2												1									1	6	1	2

Table III—*cont.*—Undersized Recruits. Age 20 Years. 1937-1938.

Height		62 to 63 inches						Over 63 inches					
Chest		Under	32½ in.	33 in.	33½ in.	34 in.	Over	Under	32½ in.	33 in.	33½ in.	34 in.	Over
Weight in pounds	Below 100	*1*			2								
	100 to 103	*1*	*1*		1	1					1	1	
	104 to 107		*1*	1	1	3		3		2 *1*	5	2	1
	108 to 112		1				2		3	4	5	4	
	Over 112							1		2			

Table III—*cont.*—Undersized Recruits. Age 21 Years. 1937-1938.

Height		Under 63 inches						Over 63 inches					
Chest		Under	32½ in.	33 in.	33½ in.	34 in.	Over	Under	32½ in.	33 in.	33½ in.	34 in.	Over
Weight in pounds	Below 100	*1*						1					
	100 to 103					1 *1*	1	1		1	1		
	104 to 107		1	1					2	2	3		
	108 to 112				2		2			1	2	1	1 *1*
	Over 112						1		1	2	1		

Table III—*cont.*—Undersized Recruits. Age over 21 Years. 1937-1938.

Height		Under 63 inches						Over 63 inches					
Chest		Under	32½ in.	33 in.	33½ in.	34 in.	Over	Under	32½ in.	33 in.	33½ in.	34 in.	Over
Weight in pounds	Below 100							1	*1*				
	100 to 103				1	1	1	1 *1*	1	3		1	
	104 to 107	*1*	1		1	2	1		1	2	3		
	108 to 112					2	3	2		1	5	3	4
	Over 112						1		2	4		1	5

retention in the Service, although no disease was apparent, and were in consequence discharged. Table IV shows further details of these cases.

A study of Table II reveals some remarkable facts. Of a total of 834 undersized recruits who arrived at the Depot, no less than 729 were passed to Regimental Depots. This represents roughly a battalion of infantry. This result is the more remarkable when it is observed that these recruits, formerly rejected in recruiting offices, become sufficiently physically fit to be trained as soldiers after a stay at the R.P.D.D. lasting on an average of nine weeks.

Again, of the 105 men discharged, a quarter of them went for reasons other than medical defects. Another fifth went on medical grounds without training; these were men who suffered from severe disability or disease. They were not considered suitable for service of any kind. This leaves 59 men who were rejected on medical grounds after training. An examination of this group shows that 17 of them had definite active disease or disability debarring them from service, while 42 failed to reach a standard sufficiently high to enable them to be passed to their depots. This represents a failure of 5 per cent on the total admissions.

These failures are shown in italics according to age, height and chest measurements in Table III. Most of the men are found at a given age to be below 104 pounds in weight, 64 inches in height, and 33 inches in maximum chest measurement. Many more men in this category pass out fit than fail, so reasons for failure must be sought outside these tables. Table IV gives some further particulars of these cases, and a study shows that in certain cases of severe malnutrition the time available to repair the damage done is quite insufficient. The ordinary time limit at this Depot is put down at three months, but often an extra month or two may be added in an effort to save men for the Service. The question of age has to be considered. It would be very easy to classify these lads as below 18 years of age and leave it at that. But after more than a year's experience of this work I have seen so many mistakes in this respect that I accept no age except on proof. Many of the lads who nine people out of ten would say were but 15 or 16 years of age would produce unmistakable evidence of their birth having taken place in the year 1920. Other lads, well developed and muscularly firm and set, with sometimes hairy chests, undoubtedly would be thought by the same nine or ten people to be nineteen years of age, but they are often only seventeen, and may be claimed out of the Service by their parents on that account. There would appear to be considerable difference between chronological and physiological age; it would be interesting to discover the factors that are responsible for the differences.

Many of this group may have some disease which would account for their being failures, but this is doubtful as the mere factor of size did not

TABLE IV.—FURTHER DETAILS OF FORTY-TWO RECRUITS WHO FAILED TO REACH THE PHYSICAL STANDARDS AFTER TRAINING.

No.	Age, years	Height, in.	Weight, lb.	Chest, in.	Remarks
1	17	64	102	33	An Anglo-Indian. No disease found
2	18	61	96	33	Reached 101 lb. after four months. Was muscularly weak
3	18	61	98	33	Poor physique. Reached 102 lb. in three months
4	18	61	99	32½	Reached 99½ lb. in three months. Had chronic infection tonsils
5	18	61	101	34½	No disease found. Reached 106½ lb. in three months
6	18	61	102	32½	No disease found. Reached 106 lb. in five months
7	18	62	93½	30½	Reached 101 lb. in weight and 32 in. chest in four months. A "bantam"
8	18	62	94	32½	Severe malnutrition. Reached 99 lb. in three months
9	18	62	96	32	Reached 105 lb. in five months. Very doubtful if 18 years old
10	18	62	99	32	Spent most of his time in hospital, severe fracture radius and ulna. Weight after ten months 102½ lb.
11	18	62	95	31	Reached 102 lb. in three months. Of doubtful age
12	18	62	103	34	Reached 105 lb. in four months. No disease found
13	18	63	94	31½	After five months max. chest measure was 33½ in., and weight was 106 lb. No disease was discovered
14	18	63	96	32½	Reached 100 lb. in five months. Nil abnormal discovered
15	18	63	98	34	Reached 103 lb. in 2½ months. Very fit. So-called "bantam"
16	18	63	100½	31½	No disease found. Reached 105 lb. in three months
17	18	63	104	32	Very poor physique. Reached 107 lb. in three months
18	18	64	97	31	Malnutrition marked. Reached 102 lb. in three months
19	18	64	98	33½	Was under E.N.T. specialist two months with mastoiditis. Made 100½ lb.
20	18	64	99	32½	Made 103½ lb. and 34 in. chest in three months. No disease discovered. ? Age
21	18	65	102	33	Made 103 lb. in three months. Weakling and doubtful age
22	18	65	108	33	No gain after two months. Disease probably present but not found
23	18	66	96½	32½	Severe malnutrition
24	18	66	99	31	Made 108 lb. and 32½ in. chest in five months. Insufficient time to develop at depot
25	19	60	103	31½	Made 108 lb. and 32 in. chest in five months. Appeared fit
26	19	61	93	31½	Reached 96 lb. and 32 in. chest in two and a half months. Doubtful age
27	19	62	94	32½	Reached 98 lb. in four months. Severe malnutrition
28	19	63	101	32½	Made 103½ lb. in four months. Doubtful age
29	19	64	102	33	No active disease found although suspected
30	19	64	98	34½	Made 104½ lb. and 35 in. chest in three months. Fit
31	20	61	107	32½	Made 109 lb. in five months. Poor muscular development
32	20	62	102	32½	Made 107 lb., then dropped to 101 lb. in three and a half months
33	20	63	94	32½	Failed to reach 100 lb. in three months. Severe malnutrition
34	20	63	100	32	Required four months to reach 106 lb. and 32½ in. chest
35	20	64	104	33	Made 107 lb. in five months. No disease found
36	21	62	97	32	Reached 105 lb. and 32 in. chest in four months. Severe malnutrition
37	25	66	111	34½	In three months made 117 lb. and 36 in. chest. A dullard
38	21	64	98	32½	Made 104½ lb. and 33 in. chest in five months. A small-sized man, medically fit.
39	21	65	100	31½	Made 106½ lb. in five months, chest 32 in. maximum expansion. Malnutrition
40	22	61	101	34	Reached 106 lb. in five months. No abnormality found
41	22	62	97	32	Only reached 104 lb. and 34 in. chest in five months. Fit
42	19	65	103	33	Reached 107½ lb. and 34 in. chest in three months. Appeared fit

conceal the fact that many of the lads were as physically fit as their larger brother recruits and that careful examination did not reveal the existence of any disease, even the blood sedimentation test gave no pointer to a deviation from health. Such examples in Table IV would be those recruits marked as medically sound, and here, besides the question of age, the question of the stock they come from makes interesting investigation. They come from small stock in most cases, but in some families one parent is large and the other small; while again both parents may have been well grown and well developed, and he the only small one in the family, suggesting a reversion to an earlier type.

The problem is exceedingly complicated as similar histories may be given by the well-grown recruit. These lads usually make excellent gymnasts and show wonderful muscular control, suppleness of movement and for their size good muscular development.

The further progress of the 729 recruits who were passed on to their Regimental Depots is interesting. After training 706 went to their battalions. The wastage then was 23 or 3·15 per cent. of those dispatched from the R.P.D.D. Of the discharges only four were discharged on grounds of ill-health, or expressed as a percentage 0·54 per cent. Of these four, one refused an operation for inguinal hernia, the second was a case of flat feet, the third suffered from defective vision, while the last had an undescended testicle with hernia. It is interesting to note that no recruit was discharged on account of defects or diseases arising from their lack of nourishment and under-development before enlistment.

The acquirement of physical fitness in the undersized recruit as the result of the application of the six cardinal principles already discussed can be demonstrated best by the examination of the progress made in increasing weight and chest measurement. There would appear to be four main ways in which this progress is manifested, viz.:—

Group A: Rapid and continuous increase.
Group B: Steady and continuous progress.
Group C: Poor progress at R.P.D.D. Rapid at Regimental Depot.
Group D: Poor progress at R.P.D.D. and at Regimental Depot.

Table V and the graph have been compiled to illustrate these groups. Each type is an actual case selected to represent his group. For purposes of comparison these types have been selected as being as near as possible of the same age, height, weight, and maximum chest measurement. The age that was chosen was 18 years, and the height 63 to 65 inches. The tallest represents Group D. There are infinite variations within each group.

TABLE V.—UNDERSIZED RECRUITS. THE INCREASE IN WEIGHT.

Group A. Rapid and continuous increase.

Month	On joining	1st	2nd	3rd	4th	5th	6th	7th	8th	9th
Weight, lb.	105	116	116½	118	119	121	126	126½	128	128¾
Max. chest meas.	32½ in.	33 in.	33½ in.	33½ in.	34 in.	34 in.	34 in.	34½ in.	34½ in.	34½ in.

Group B. Steady and continuous progress.

Month	On joining	1st	2nd	3rd	4th	5th	6th	7th	8th	9th
Weight, lb.	106	110	111½	112	114	114½	115	115½	118	119
Max. chest meas.	32½ in.	33 in.	33 in.	33 in.	33½ in.	33½ in.	33½ in.	34 in.	34 in.	34 in.

Group C. Poor progress at R.P.D.D. Rapid at Regt. Depot.

Month	On joining	1st	2nd	3rd	4th	5th	6th	7th	8th	9th
Weight, lb.	106	110	109½	109	110	112	117	118	119	—
Max. chest meas.	32½ in.	33 in.	33 in.	33 in.	33 in.	33½ in.	34¼ in.	34½ in.	34½ in.	—

Group D. Poor progress at R.P.D.D. and at Regt. Depot.

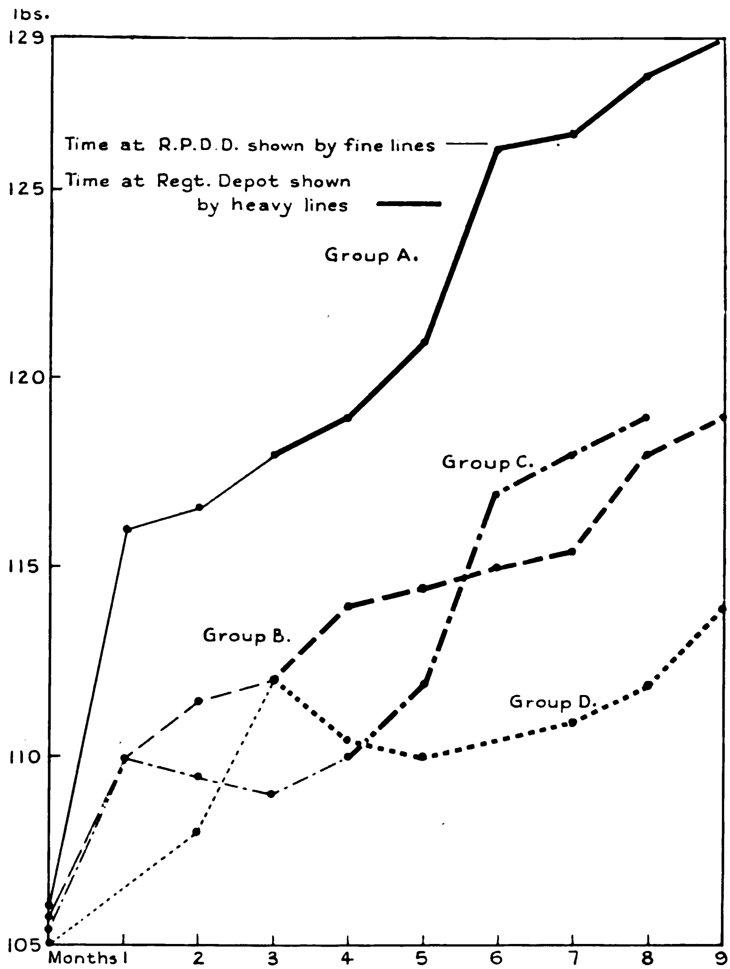
Month	On joining	1st	2nd	3rd	4th	5th	6th	7th	8th	9th
Weight, lb.	105	—	108	112	110½	110	—	111	112	114
Max. chest meas.	32½ in.	—	32½ in.	33 in.	33 in.	33 in.	—	34 in.	35 in.	35 in.

Group B is the method by which the majority of our recruits advance. There is an initial increase of 4 to 6 pounds in the first month and this is followed by a gradual increase of ½ to 2 pounds a month for about five to six months and then a more rapid increase for a short period.

In Group A the increase in weight proceeds by the same kind of progression, but a larger amount of weight is put on within the same period of time. In the type case it was no less than 24 pounds. The initial rise was 10 pounds in the first month and the period of slow progression is shorter before the second increase.

Type case illustrating Group C shows a different picture; the initial increase was 4 pounds in the first month. But although he remained at the Depot another three months his weight did not increase. During the first two months at the Regimental Depot he put on seven pounds and eventually left there weighing 119 pounds after a total service of eight months. Cases of this type are not very numerous.

The Group D type are still fewer in number and the records available do not show what happens to these men's weight after they join their battalion from their Regimental Depot, but from the results of the experiment with the first thirty men it would appear that this group can be subdivided into those who eventually make weight in their battalions and those who do not.



THE GRAPH.

Table VI shows the causes for rejection in undersized recruits who were discovered to have definite lesions. It was noticed that disease may attack any recruit irrespective of his build. Cases showing tubercular infection are not confined to those who displayed the most marked malnutrition. In fact, they may be discovered in those who appear the most healthy. Two cases of tubercle of the lung were diagnosed by X-ray examination and were of the pre-clinical type. The cases of tubercular infection of other organs were one of tubercular peritonitis and another of tuberculosis of the kidney.

TABLE VI.—CAUSES OF REJECTION. UNDERSIZED RECRUITS WITH ACTIVE DISEASE.

Cause of rejection	Without training	After training
Under height	1	—
Insufficient weight	5	—
Impaired constitution and debility	—	1
Affections of bones, joints and muscles :—		
Pes cavus	1	—
Hallux rigidus	1	—
Hallux valgus	1	—
Other defects lower extremities	1	1
Diseases of the nervous system :—		
Epilepsy	2	—
Other diseases of the nervous system ..	1	—
Affections of the ear :—		
Chronic otitis media	1	1
Diseases of the respiratory system :—		
Nasal obstruction	—	1
Tubercle of the lung	2	1
Bronchitis and fibrosis	1	4
Other diseases of the respiratory system ..	1	1
Diseases of the circulatory system :—		
Valvular disease of the heart	—	2
Other diseases of the circulatory system ..	—	2
Tuberculosis (other than that of the lungs) ..	1	1
Other general diseases	1	2
Total ..	20	17

The five cases of insufficient weight who were discharged without training were all below 97 pounds in weight, one being 89 pounds. They usually also suffered from malnutrition and were, moreover, suspected of being below the age of 18 years.

The cases of valvular disease of the heart were interesting because of the interval between the rheumatic fever and the onset of the cardiac condition. It was three years almost to the month. Neither case had tachycardia and early symptoms of precardial distress led to the discovery of the murmur. The murmurs were extremely difficult to hear and were mid-diastolic in time and located over the mitral area. No recruits were discovered having evidence of helminths.

TABLE VII.—ADMISSIONS TO HOSPITALS. UNDERSIZED RECRUITS.

Diseases	1937 May to Aug.	Sept. Oct. Nov.	1938 Dec. Jan. Feb.	March April May	June and July	Total
Common cold	—	—	—	3	—	3
Influenza	—	—	7	3	—	10
Inflammation of pharynx	—	—	—	1	—	1
Inflammation of tonsils	1	—	3	3	1	8
Tonsillectomy	—	2	—	4	5	11
Malaria	—	1	—	—	—	1
Mumps	—	—	—	1	—	1
Scarlet fever	—	—	—	1	—	1
Measles	—	—	—	1	—	1
Scabies	3	—	1	3	—	7
Diseases of the—						
Nervous system	—	2	1	—	—	3
Circulatory system	—	—	1	—	—	1
Blood and blood-forming organs ..	—	1	—	1	—	2
Respiratory system	1	1	4	6	2	14
Digestive system	1	2	—	—	—	3
Bones, joints, muscles and fasciæ..	1	2	—	—	—	3
Areolar tissue	3	4	2	3	—	12
Skin	—	1	2	2	—	5
Local injuries	2	2	3	2	—	9
All other diseases	—	3	—	—	—	3
Total	12	21	24	34	8	99

Table VII shows the admissions to hospital covering the period under investigation. The table includes those sent to hospital to undergo investigation and who were afterwards discharged the Service. It, however, excludes many who were discharged but who were not at any time admitted to hospital.

As might be expected after the remarks made about the lack of development of the chest and of the knowledge of breathing, the largest number of admissions for any one disease is to be found under the heading "Diseases of the Respiratory System." Admissions for diseases of the areolar tissue come second and then cases for tonsillectomy. Of the tonsillectomy cases all but three proceeded to their depots, and several recruits went to their depots with a recommendation for the removal of their tonsils at some future date.

There was quite a big outbreak of mild influenza during the spring and it swept through the barracks but only ten men required hospital treatment for that condition. Of infectious diseases there was one case each of mumps, scarlet fever, and measles. There were also seven cases of scabies infection. All these cases appear to have had the infection when they arrived at the Depot.

Local injuries accounted for nine admissions, three of which were for fractures of the upper extremity.

Pte. A. Age 18. Butcher's Assistant.

	On enlistment May 23	June 7	June 22	July 4	July 19	Aug. 2	Aug. 15	Aug. 29	Sept. 12	Sept. 28
Weight, lb. ..	99½	103½	102½	104	107½	106½	106	108½	111	112
Chest, inches ..	31½	32	32½	32½	32½	33	33	32½	33	33½
Pulse	80	83	84	96	88	90	92	—	86	78

Gained 12½ lb. in 4 months.

Note transition from weakness to power both in physique and facial expression.

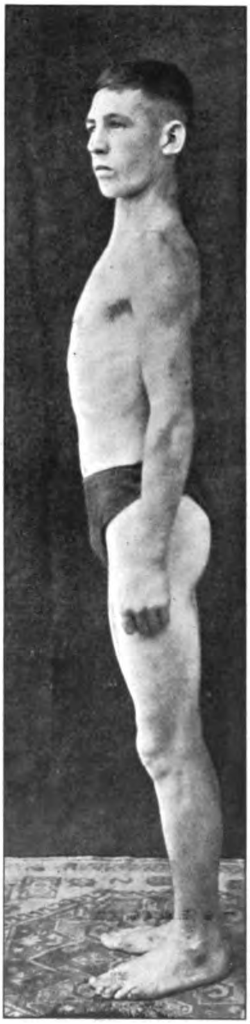


Fig. 1.—Before training. Fig. 2.—After training.

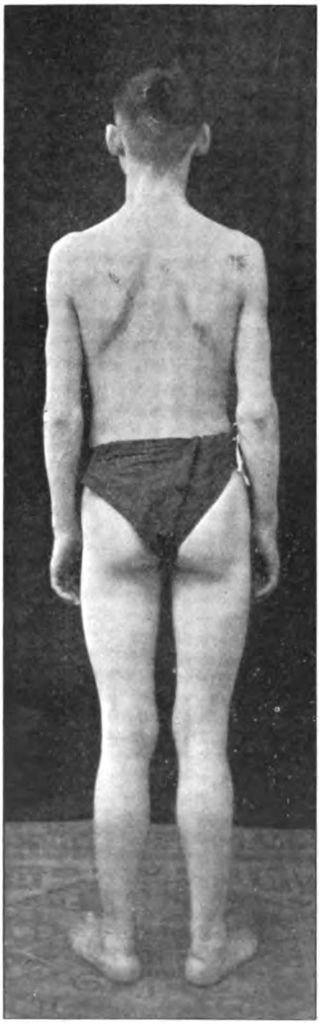


Fig. 3.—Before training.

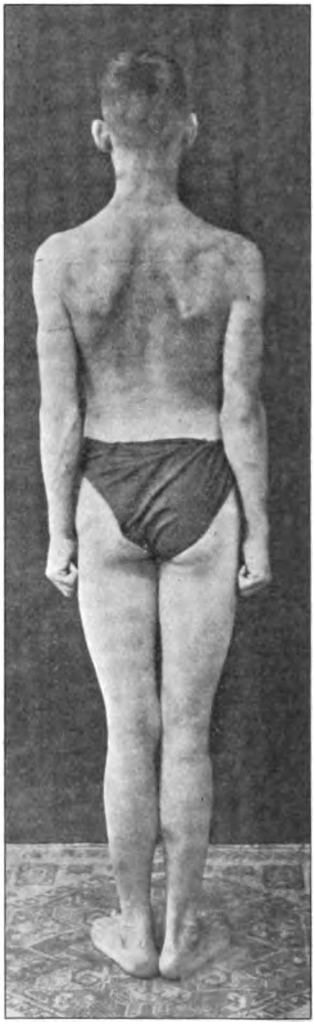


Fig. 4.—After training.

Pte. B. Age 18. Driller.

	On enlistment, May 19	May 31	June 14	June 27	July 12	July 26
Weight, lb.	104½	107	109½	110½	111	112
Chest, inches	32	32½	32½	33	33	33
Pulse	72	72	80	80	78	76

Gained 7½ lb. in 9 weeks.

Note again the transition from weakness to power and very marked change in facial expression.

Fig. 5.—Before training.

Fig. 6.—After training.

Table VII shows the prevalence of disease as seen on the morning sick parade, except that a large number of trivial cases are present; these cases are mainly recruits who complain of stiffness of the muscles due to unusual exercise and so on.

The ultimate result of this attempt to give every young man who so desires an opportunity to adopt the profession of arms cannot be known for some time to come. From reports and information received from time to time it would appear that the recruits who pass through the R.P.D.D. do well both in their depots and in their regiments as a rule. There are, of course, those who do not succeed, but, so far as is known, the proportion of wastage is remarkably small considering their physical condition on joining the Service.

It is very pleasant to know that the undersized recruit appreciates what is done for him. Many letters have been received by the Commandant expressing this appreciation. Very often they come from quite unexpected sources. To close this article, two letters, culled from the files, are reproduced:—

LETTER No. 1.

DEAR SIR,—We thought we would write to you to tell you that both myself and Sgm. M—— won the Colonel's Whip at the end of our fourteen weeks' training for being the cleanest and smartest men in our squads.

I myself finished Depot trng 4 weeks ago and am now learning my trade which is a lineman. Sgm M—— finished his Depot training yesterday (Saturday) and now goes to C Company to learn his trade as a Despatch Rider.

Just recently I have won my place in the Signals training corps cross country running team. I hope to be running at Harrogate next Saturday.

We both think had it not been for our R.P.D.D. trng we would not have had the honour of receiving the Colonel's Whip.

We both wish to thank you and your staff.

We remain your obedient servants,

(sd) Sgm. W—— and
(sd) Sgm. F. M——.

LETTER No. 2.

SIR,—I'm writing this my first letter to you my first C.O. thanks to you and the grand staff under you I've had a better chance than most recruits. I'm fit, happier than ever I was working underground. The way the Army looks after us is wonderful. I can truthfully say it's been the best part of a life mostly spent in a mining area. I've passed my exams trade group 3, making my pay 3/4 a day with 4/- in view in 18

months' time, so I'm not short, in fact I can say for the first time in my life.

I've tried to write to you before. I'm rather proud to be the first R.A.M.C. chap who joined up under the R.P.D.D. Words are poor things to express my happiness, the feeling fit that I so enjoyed under you.

I'm a poor letter writer but it all boils down to the fact that the R.P.D.D. was my entrance to the Army and I'd like to thank you and the Sgt. Major, Staff Sgt. Barrington, Cpl. Jones, Cpl. Munday. I do hope they are still doing the good work.

So a Merry Christmas, sir, to you all.

Your obedient soldier,

——— Pte., R.A.M.C.,

Palestine.

Before concluding this article it remains for the author to thank Major-General H. H. A. Emerson, C.B., D.S.O., for permission to forward it for publication and Colonel D. T. Richardson, M.C., for his kindness in checking the script and making many helpful suggestions, a kindness that is greatly appreciated.

APPENDIX I.

Recruits' Physical Development Depot.

Diet Sheet for Week ending June 18, 1938.

Day and Date	Gunfire	Breakfast	Break	Dinner	Tea	Supper
Sunday 12th	Nil	Porridge and hot milk Fried egg and bacon Tea, bread, marg., marm.	Milk Apple	Roast mutton, mint sauce Peas, roast potatoes Stewed figs and custard	Tea, bread, butter Jam Swiss roll	Cold roast mutton Beetroot salad Tea, bread, marg.
Monday 13th	Tea Barley sugar Biscuits	Porridge and hot milk Fried bacon and tom. beans Tea, bread, marg., marm.	Soup Bread	Meat pie, cabbage Mashed potatoes Rhubarb tart and cream	Milk, banana Bread, butter Jam tart	Cottage pie Bubble and squeak Cocoa, bread, marg.
Tuesday 14th	Tea Barley sugar Biscuits	Porridge and hot milk Fried liver and onions Tea, bread, marg., marm.	Milk Apple	Roast beef, Yorkshire pudd. Beans, roast potatoes Vermicelli pudding	Tea, bread, butter Cheese and onions	Fried fish and chips Tea, bread, marg.
Wednesday 15th	Tea Barley sugar Biscuits	Porridge and hot milk Steak and onions Tea, bread, marg., marm.	Soup Bread	Brown stew, cabbage Boiled potatoes Baked jam roll and custard	Milk, banana Seed cake	Meat pasties and mash Tea, bread, marg.
Thursday 16th	Tea Barley sugar Biscuits	Porridge and hot milk Steamed liver and bacon Tea, bread, marg., marm.	Milk Apple	Rabbit pie, cabbage Mashed potatoes Banana cream	Tea, bread, butter Beef and ham roll Salad	Fish cakes and sauce Cocoa, bread, marg.
Friday 17th	Tea Barley sugar Biscuits	Porridge and hot milk Fried egg and sausage Tea, bread, marg., marm.	Soup Bread	Lancashire hot pot Baked beans, potatoes Boiled roll and syrup	Milk, bread, butter Russian cake	Cold beef and pickles Tea, bread, marg.
Saturday 18th	Tea Barley sugar Biscuits	Porridge and hot milk Rissole and bacon on fried bread Tea, bread, marg., marm.	Milk Banana	Irish stew, peas Potatoes Fruit salad, cream	Tea, bread, butter Jam	Fried egg and chips Tea, bread, marg.

Recommended. (Sgd.) F. C. Papworth, Captain,
Officer i/c Messing No. 1, R.P.D.D.

Approved. (Sgd.) N. P. Procter, Major,
Commandant No. 1, R.P.D.D.

RECRUITS' PHYSICAL DEVELOPMENT DEPOT.

DIET SHEET FOR WEEK ENDING JULY 9, 1938.

Day and Date	Gunfire	Breakfast	Break	Dinner	Tea	Supper
SUNDAY 3rd	Nil	Porridge and hot milk Fried egg and bacon Tea, bread, marg., marm.	Milk Apple	Roast mutton, mint sauce Peas, potatoes Figs and custard	Tea, bread, butter Cheese and onions Salad	Cold mutton and pickles Cocoa, bread, marg.
MONDAY 4th	Tea Biscuits Barley sugar	Porridge and hot milk Boiled ham (hot), beans Tea, bread, marg., marm.	Milk Banana	Brown stew, cabbage Potatoes Baked jam roll, custard	Tea, bread, butter Fruit cake	Fish cakes and sauce
TUESDAY 5th	Tea Biscuits Barley sugar	Porridge and hot milk Diver and onions Tea, bread, marg., marm.	Milk Apple	Lancashire hot pot Beans, potatoes Gooseberry tart, cream	Tea, bread, butter Beef and ham roll Lettuce	Beef, olives Mash Tea, bread, marg.
WEDNESDAY 6th	Tea Biscuits Barley sugar	Porridge and hot milk Sausage and fried egg Tea, bread, marg., marm.	Milk Banana	Roast beef, peas, Yorkshire pudding, potatoes Rice pudding	Tea, bread, butter Jam tartlets	Fried fish and chips Tea, bread, marg.
THURSDAY 7th	Tea Biscuits Barley sugar	Porridge and hot milk Fried rissole and bacon Tea, bread, marg., marm.	Milk Apple	Irish stew, cabbage Potatoes Rhubarb tart, cream	Tea, bread, butter Russian cake	Cold pressed beef Sauce Cocoa, bread, marg.
FRIDAY 8th	Tea Biscuits Barley sugar	Porridge and hot milk Boiled fish and mash Tea, bread, marg., marm.	Milk Banana	Meat pie, potatoes, beans Boiled sultana roll White sauce	Tea, bread, butter Sultana cake	Meat pasties Potatoes Tea, bread, marg.
SATURDAY 9th	Tea Biscuits Barley sugar	Porridge and hot milk Fried liver and bacon Tea, bread, marg., marm.	Milk Apple	Toad in the hole Cabbage, potatoes Prunes and custard	Tea, bread, butter Jam	Cheese patties Tea, bread, marg.

Recommended. (Sgd.) F. C. PAPWORTH, Captain,
Officer i/c Messing No. 1, R.P.D.D.

Approved. (Sgd.) N. P. PROCTER, Lieut.-Col.,
Commandant No. 1, R.P.D.D.

RECRUITS' PHYSICAL DEVELOPMENT DEPOT.

DIET SHEET FOR WEEK ENDING FEBRUARY 18, 1939.

Day and Date		Gunfire	Breakfast	Break	Dinner	Tea	Supper
SUNDAY 12th	208/240	Nil	Porridge and hot milk Fried egg, bacon, tomatoes Tea, bread, marg., marm.	Milk Banana	Roast mutton, mint sauce Cabbage, roast potatoes Apple pudding and custard	Tea, bread, butter Savoury paste	Cold mutton Pickles Tea, bread, marg.
MONDAY 13th	210/240	Tea Biscuits Barley sugar	Porridge and hot milk Bacon on fried bread Tea, bread, marg., marm.	Cocoa Apple	Meat and potato pie Swedes, potatoes Rice pudding	Tea, bread, butter Banana	Stewed steak and fried onions Tea, bread, marg.
TUESDAY 14th	215/250	Tea Biscuits Barley sugar	Porridge and hot milk Fried sausage and mash Tea, bread, marg., marm.	Soup Bread	All-in stew, dumplings Carrots, potatoes Semolina pudding	Milk, bread, butter Lemon curd tarts Banana	Fish and chips Tea, bread, marg.
WEDNESDAY 15th	220/255	Tea Biscuits Barley sugar	Porridge and hot milk Poached egg and mince Tea, bread, marg., marm.	Milk Apple	Roast beef, Yorkshire pudd. Peas, potatoes Prunes and custard	Tea, bread, butter Fish cake Orange	Cheese and onion sandwiches Tea
THURSDAY 16th	220/255	Tea Biscuits Barley sugar	Porridge and hot milk Fish pie, tomato sauce Tea, bread, marg., marm.	Soup Bread	Liver cottage pie Cabbage, potatoes Date roll and custard	Milk, bread, butter Ginger slab cake Orange	Liver and bacon stew Tea, bread, marg.
FRIDAY 17th	200/235	Tea Biscuits Barley sugar	Porridge and hot milk Scrambled egg on fried bread and bacon Tea, bread, marg., marm.	Cocoa Apple	Lancashire hot pot Swedes, potatoes 7-cup pudding and chocolate sauce	Tea, bread, butter Buns split with jam	Scotch eggs Tea, bread, marg.
SATURDAY 18th	205/240	Tea Biscuits Barley sugar	Porridge and hot milk Fried sausage and bacon Tea, bread, marg., marm.	Milk Banana	Boiled salt beef Carrots, potatoes Baked apple and custard	Tea, bread, butter Sardine sandwiches	Cheese and onions Tea, bread, marg.

Recommended. (Sgd.) F. C. PAPWORTH, Captain,
Officer i/c Messing No. 1, R.P.D.D.

Approved. (Sgd.) N. P. PROCTER, Bt. Lieut. Col.,
Commandant No. 1, R.P.D.D.

RECRUITS' PHYSICAL DEVELOPMENT DEPOT.

DIET SHEET FOR WEEK ENDING FEBRUARY 25, 1939.

Day and Date		Gunfire	Breakfast	Break	Dinner	Tea	Supper
SUNDAY 19th	200/232	Nil	Porridge and hot milk Egg, bacon and tomatoes Tea, bread, marg., marm.	Milk Banana	Roast mutton, mint sauce Cabbage, roast potatoes Boiled jam roll, custard	Tea, bread, butter Madeira slab cake Orange	Cold mutton Mixed pickles Tea, bread, marg.
MONDAY 20th	200/232	Tea Biscuits Barley sugar	Porridge and hot milk Stewed steak and chips Tea, bread, marg., marm.	Soup Bread	Lancashire hot pot Peas, potatoes Apple pudding and custard	Milk, bread, butter Eccles cakes	Fried bacon on fried bread Tea, bread, marg.
TUESDAY 21st	205/240	Tea Biscuits Barley sugar	Porridge and hot milk Fish balls, tomato sauce Tea, bread, marg., marm.	Cocoa Apple	Roast beef, Yorkshire pudd. Cabbage, roast potatoes Stewed figs and custard	Tea, bread, butter Cocoanut rocks Apple	Scotch eggs Tea, bread, marg.
WEDNESDAY 22nd	205/240	Tea Biscuits Barley sugar	Porridge and hot milk Fried sausage and bacon Tea, bread, marg., marm.	Milk Banana	Liver cottage pie Baked beans, sauté potatoes Steamed ginger pudding and custard	Tea, bread, butter Rissole and fried onions	Ham sandwiches Tea
THURSDAY 23rd	210/245	Tea Biscuits Barley sugar	Porridge and hot milk Poached egg and mince Tea, bread, marg., marm.	Soup Bread	Meat pudding Cabbage, potatoes Stewed prunes and custard	Tea, bread, butter Cookies Banana	Fried fish and chips Tea, bread, marg.
FRIDAY 24th	190/222	Tea Biscuits Barley sugar	Porridge and hot milk Sausage and mash Tea, bread, marg., marm.	Cocoa Apple	Hot boiled ham, potatoes Mashed swedes and onions Spotted Dick and custard	Tea, bread, butter Jam puffs	Fried egg and chips Tea, bread, marg.
SATURDAY 25th	195/227	Tea Biscuits Barley sugar	Porridge and hot milk Bacon and tomato beans Tea, bread, marg., marm.	Milk Banana	Boiled salt beef, carrots Potatoes Date pudding and custard	Tea, bread, butter Herrings in tomato sauce	Salmon Sandwiches Tea

Recommended. (Sgd.) F. C. PAPWORTH, Captain,
Officer i/c Messing, No. 1, R.P.D.D.

Approved. (Sgd.) N. P. PROCTER, Bt. Lieut.-Col.,
Commandant, No. 1, R.P.D.D.

APPENDIX II.

A Selection of Remedial Exercises in Use at the Depot. They are from the Scheme Arranged by Captain Calderbank, the Supervising Officer in Charge of Physical Training.

(1) On page 37 is Part I of a Table of Exercises. Part II consists of apparatus exercises, using beams, wall bars, seven pound medicine balls, benches, ropes, etc. The excercises are carried out in the following stages :—

1st Stage, about three weeks, general suppling, inculcation of good habits, posture. Breathing, co-ordination, brain stimulation in game form. Apparatus is used but little.

2nd Stage, further three weeks, suppling exercises in progressive form with a bias to the thorax and spine, with an addition of *light strengthening exercises* on apparatus.

3rd Stage, further three weeks, general suppling exercises with full range of movement, with an addition of strengthening exercises to cover the whole body. Medicine ball and beams.

4th Stage, further three weeks. During this stage all exercises of a building and strengthening nature are used. The pupil is supple and his body is responsive to stronger work, he can absorb intensive exercise. Full use can be made of ropes, beams, benches and medicine balls.

(2) Competitive team games are inserted in the Tables between Parts I and II.

(3) Medicine ball exercises can be given in "game form" as well as Class Control.

(4) All exercises which recur or are similar to those in P.T. Tables are omitted.

THE EXERCISES: SELECTED FROM STAGE I EXERCISES.

	Starting position.	*The Exercises.*	*Effect and Object of Exercise.*
1.	Standing, feet closed.	Alternate heel raise and lower weight from one foot to the other.	Supple the toes and ankle joints. Strengthen the calf muscles.
2.	do.	Both heels raise and lower, with arms swing forwards, downward, sideways.	The same effect as in Exercise 1 with co-ordination and balance.
3.	do.	Knees bend and stretch, keeping heels on floor. Knees kept closed.	Gives flexion to ankle joints.
4.	Crouch position, knees closed.	Low knee springs. Weight to be taken on toes and hands.	Supples the great toe joint.
5.	do.	Arms bending and weight to be taken on toes and hands.	Progression on Exercise 4. Also strengthens arms.
6.	Horizontal kneel	Head dropping and bending backward. Full range of movement.	Gives mobility to head. Used for correcting faulty carriage of the head.
7.	do.	Raise to bend front support. Heels raise and lower in counts of four.	Abdominal strength. Supples toes and ankles. Stretches ham strings and Achilles tendons.
8.	do.	Raise to bend front support. Shoulder pressing downward in counts of four.	Stretches pectorals. Gives mobility to shoulder joints.
9.	do.	Hands wider than shoulders apart. Arms bend, chest to thighs, keeping chest low. Glide forward and resume starting position.	Expands the chest—used for round shoulders and kyphosis.
10.	Horizontal sitting position.	Feet extending, flexing and inverting.	Give "Rest Period" in Table, also strengthens muscles of the foot and ankle.
11.	do.	Press alternate knee to chest, grasping shin with both hands.	Abdominal strength, corrects lordosis, strengthen back muscles.
12.	do.	Trunk drop with hands forward reach in counts of four. Legs kept straight.	Gives mobility to lumbar spine, stretches ham-strings.
13.	do.	Arms crossed, arms swing to sideways, breathing time. Back straight.	Strengthens back muscles. Stretches pectorals, gives chest mobility.
14.	Back lying, supported on forearms.	Knees bending and stretching, heels clear of floor.	Abdominal strength. Corrects lordosis.
15.	Back lying, knees bent, arms sideways.	Spanning in breathing time. Press with the head and hands.	Dorsal strength. Chest mobility.
16.	Lying side support on hip, legs crossed.	Hip raise to support on hand and feet. (Slowly.)	Lateral strength. Used for correction of lateral curvatures.
17.	Prone lying. Hands backward clasped.	Trunk raise with arms stretched downward.	Dorsal strength. Corrects round shoulders.
18.	Back lying.	Complete relaxation.	To educate pupil to relax all muscles.
19.	Posture exercise.	To teach sitting and standing.	To educate pupil in correct positions of sitting, walking and standing.
20.	Standing astride, hands placed on lower ribs.	Breathing exercise.	Hands are placed on lower ribs so that pupil can "feel" movement.

APPENDIX III.

The Assessment of Physical Fitness at the Recruit's Physical Development Depot, Canterbury.

The following methods are adopted to estimate the physical fitness of recruits :—

(1) *Fortnightly Inspections.*

(*a*) Clinical search for and remedying such lesions as may interfere with progress. This includes Laboratory, X-ray and Specialist Reports.

(*b*) Recording progress. Observations are made on height, weight, maximum chest measurement, pulse rate and any special defect undergoing remedial treatment, e.g. deformities of the spine, anæmia, tachycardia, etc. Note is also made of improvement in general well being, nutrition and mental alertness.

(2) *Physical Fitness Tests in the Gymnasium (Passing-out Test).*

(*a*) *Freedom of Action in Walking and Running.*—Recruits walk and run around the gymnasium. A free and natural action of the shoulders and hips, knees and ankles is expected.

(*b*) *General Co-ordination of Movement.*—(i) Visual—The instructor carries out simple exercises new to the recruit, who has to copy them and is expected to get them right rapidly. No word is spoken. (ii) Auditory—Brief unusual orders are given unexpectedly. The speed and accuracy are noted. In addition, the usual exercises to test co-ordination are carried out.

(*c*) *Mobility.*—Exercises are set to test—The shoulder-group of muscles. The lumbar and ham-string muscles. Lateral mobility. Suppleness of toes, ankle, knees and hips. Mobility of thorax and vertebrae.

(*d*) *Strength.*—The shoulder-group is tested by requiring each recruit to hang from the beam and pull up to the chest four times.

The abdominal muscles are tested by requiring the recruit hanging from the wall-bars to raise his knees to his chest four times.

The lumbar and spinal groups of muscles are tested from the high prone lying position with the heel support over a bench. Then without hand support, the head and shoulders are passed beneath the seat and then brought back; the arms are now extended and the head and shoulders raised as far as possible.

(*e*) *Agility.*—Pure agility is tested for. Four benches are placed in series and the recruit is required to jump on and off each bench in quick succession without a pause. He repeats the exercise, this time jumping over each bench.

(*f*) *Posture.*—The usual plumb-line test.

(*g*) *Controlled Movement.*—Balance.

(3) *Physical Fitness Tests outside the Gymnasium.*—Tests for endurance, stamina and courage.

(*a*) Cross country run. Time taken is of lesser importance than finishing the run in fair condition.

(*b*) The mile race. Experience shows that the time taken is usually about six to six minutes ten seconds. Over seven minutes indicates unfitness. The test is for endurance and stamina, but observation is made on the recruit's general condition on arrrival.

(*c*) Boxing Three rounds, two of one minute and one of two minutes. Recruits are expected to go full out in each round to show stamina and courage. His ability to take punishment without flinching is also noted.

Besides these tests he is also expected to reach fourteen feet in the long jump and three feet eight inches in the high jump.

NOTES.

(1) The tests (*a*) and (*b*) are the important ones. Test (*c*) is a very general test.

(2) Recruits are not kept back because they fail in any one of the above tests. They are judged by the general result of their performance.

(3) They are of course going only to Depots from which they are eventually passed out.

GENEIFA.

BY MAJOR R. F. WALKER, M.C.
Royal Army Medical Corps.

ARTICLE 8 of the Treaty of Alliance between His Majesty in respect of the United Kingdom and His Majesty the King of Egypt, dated August 26. 1936, reads :—

"In view of the fact that the Suez Canal, whilst being an integral part of Egypt, is a universal means of communication as also an essential means of communication between the different parts of the British Empire. His Majesty the King of Egypt, until such time as the High Contracting Parties agree that the Egyptian Army is in a position to ensure by its own resources the liberty and entire security of navigation of the Canal, authorizes His Majesty the King and Emperor to station forces in Egyptian territory in the vicinity of the Canal, in the zone specified in the Annex to this Article, with a view to ensuring in co-operation with the Egyptian forces the defence of the Canal."

Paragraph 2 of the above-mentioned Annex reads :—

"The British Forces to be maintained in the vicinity of the Canal will be distributed

(*a*) as regards the land forces, in MOASCAR and the GENEIFA Area on the South-West side of the Great Bitter Lake and

(*b*) as regards the Air Forces within 5 miles of the Port Said-Suez Railway from KANTARA, in the North, to the junction of the railway Suez-Cairo and Suez-Ismailia in the South, together with an extension along the Ismailia-Cairo Railway to include the Royal Air Force Station at ABU-SUEIR."

In an agreed minute attached to the Treaty "Geneifa Area" mentioned in paragraph 2 (*a*) of the Treaty is further defined as "The area along the shore of the Great Bitter Lake from a point 3 kilometres North of Geneifa Station to a point 3 kilometres South-East of Fayid Station to a depth of 3 kilometres from the shore of the lake."

TOPOGRAPHY.

The area is roughly sickle shaped with the concavity facing east. It is flat from north to south with a gentle slope from the hills in the west to the edge of the Great Bitter Lake in the east.

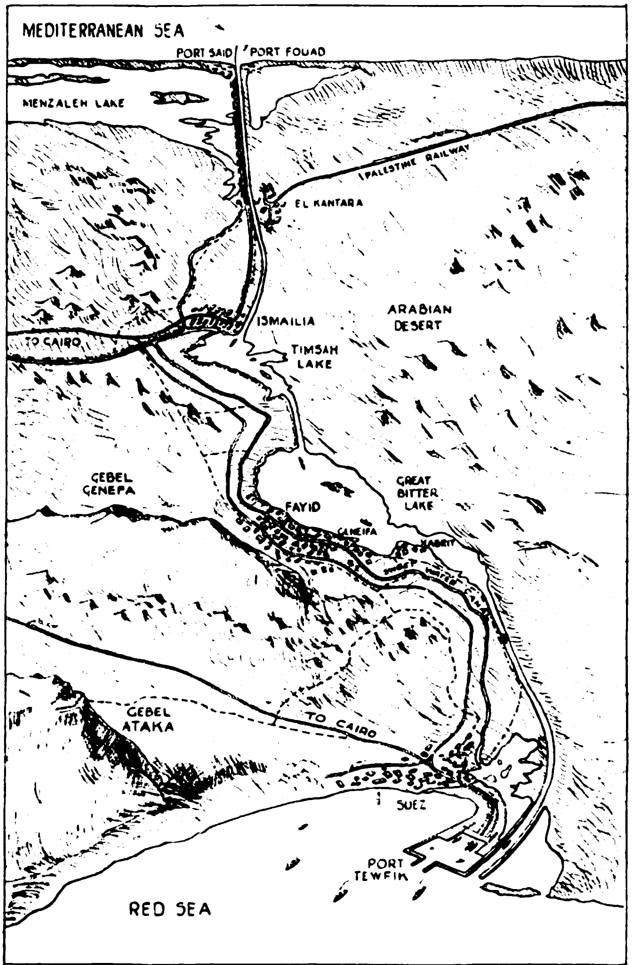
The Ismailia-Suez road running north and south and the Sweet Water canal running more or less parallel to the road and some 800 metres to the west of it divide the area into three zones :—

Zone 1 : The zone between the lake and the road.
Zone 2 : The zone between the road and the canal.
Zone 3 : The zone between the canal and the hills in the west.

Zone 1 varies in depth from a metre to 100 metres or so. It is unculti-

vated for the most part and is covered with rushes and low scrub. In the Fayid area to the north large " birkas " are found.

Zone 2 is cultivated with a variety of crops. Wet cultivation exists in considerable areas. Date palms and other trees are sparsely scattered throughout this area. The houses of the inhabitants are mostly in this zone,



BIRD'S EYE VIEW
CANAL ZONE
ANGLO - EGYPTIAN TREATY BUILDING COMMITTEE

strung out along the east bank of the Sweet Water canal. In the Fayid area houses are also built on the west bank, i.e. in Zone 3.

Zone 3 is virgin desert. For some 800 to 1,000 metres to the west the ground slopes gently upward but as the hills are approached the gradient increases sharply. The hills in the west rise to 300 metres and the eastern slopes are deeply scored by water channels (wadis). It is conceivable that

very considerable volumes of water may come down from the hills towards the cantonment area during storms, but storms are of rare occurrence.

Plan of the New Cantonment.

From north to south the area has been allocated as follows :—

Fayid from 34–38 kilometres from Ismailia	R.A.F.
Geneifa (North) from 38–50 kilometres from Ismailia ..	Army
Geneifa (South) from 50–54 kilometres from Ismailia ..	R A.F.
Kabrit Peninsula	R.A.F.

As the project stands at present it is proposed that Zone 1 throughout the area shall be developed for aquatic recreation (swimming, sailing, etc.), but on the two larger areas in this zone will be sited the residences of the G.O.C.-in-C. and G.O.C.

Zone 2 will contain the residential area, officers' quarters, married quarters, etc., together with the headquarters' offices and garrison sports grounds. The military hospital will be sited in this zone in the middle of the Army area.

In Zone 3 will be sited the main barracks, depots, and civil town.

All buildings will be sited facing north or north-east, so that full advantage may be taken of the prevailing wind and the view over the lake. The plans for quarters, etc., have been designed with a view to ensuring adequate through ventilation in every room, and for the housing of the troops the "Sandhurst Block" has been adapted to meet local climatic conditions.

In all living rooms in married quarters, etc., 33⅓ per cent has been added to the superficial area allowed in the home synopsis, whilst the height has been fixed at 12 feet. In barracks the heights of rooms will be 13 feet as laid down in Barrack Synopsis, and 33⅓ per cent has been added to the superficial area of sleeping accommodation, etc., but not to sitting rooms, stores, etc.

Water Supply.

The water supply is dependent entirely on the Sweet Water canal which takes off from the Nile just below Cairo, runs to Ismailia, and there divides into the Port Said and Suez branches. The Suez branch runs through the Geneifa area from north to south. Borings have been tried at various points within and immediately outside the area without success.

The water in the canal is turbid and the quality shows seasonal variations, bacteria increasing greatly when the Nile is in flood during August, September and October.

A recent analysis gave the following figures in parts per million :—

pH	7·8
Total solids	190
Perm. hardness	Nil
Alkalinity	18
Chlorine	21
Sod. chloride	37
Nitrates	Nil
Nitrites	Nil
Ammonia	Nil
Lactose fermenters in 10 c.c. ..	37
Bacteria in 1 c.c.	310

Apart from the ordinary purification requirements to be undertaken the question of schistosomiasis arises as *Planorbis boissyi* abound in the canal.

It is known that storage of water for forty-eight hours will kill cercariæ, but this length of storage entails extensive tank construction at a heavy cost.

The chief waterworks in Egypt (Cairo, Alexandria and Tanta) treat canal Nile water as follows: (1) Precipitation with aluminium sulphate; (2) filtration through standard quartz sand; (3) chloramination.

In one of the Cairo waterworks only six hours elapses between the intake and delivery to the customer's tap, yet cases of bilharziasis directly attributable to the water supply are unknown.

Griffith-Jones, Atkinson and Hassan Ali [1] have shown that chloramine one part per million in filtered water kills cercariæ in one hour. Chlorine from "bleach" in the same strength requires contact with the cercariæ for four hours.

Wittenberg and Yofe [2] have also shown that chlorine prepared by the Army water cart method kills cercariæ with certainty in seventy minutes when the initial concentration of available chlorine is 0·36 parts per million and state that chloramine is the most effective form of chlorine tested for this purpose.

The opinion has been expressed by the authorities of one of the most modern water works in Egypt that most of the cercariæ in water are destroyed in the precipitation tanks by being caught up in the floc.

Although the actual method of water purification to be used at Geneifa has not yet been decided upon, it is probable that the general methods employed by civilian waterworks in Egypt will be followed with perhaps a heavier dose of chloramine followed by dechloramination with activated carbon.

Drainage.

Owing to the flatness of the area the question of sewage disposal presents a problem of some difficulty. It is proposed to divide the project into four or more areas each with a sub-pumping station leading to the main sewage disposal works. The main works will be situated at the southern end of the Geneifa Area east of the Sweet Water canal. The outfall will be into the Great Bitter Lake in the neighbourhood of kilometre 53. The works will be designed for a very high degree of purification and the purified effluent will be discharged approximately 1,000 metres from the shore.

Climate.

The climate is equitable, with the prevailing wind from the north-east. There is always a breeze in the morning and evening. Rainfall is confined to a few tropical storms in the year.

The following table gives the mean temperatures at Ismailia meteorological station, which is situated some 40 kilometres north of Geneifa.

MEAN DRY AND WET BULB TEMPERATURES IN DEGREES F. AND THE RELATIVE HUMIDITY.

	Dawn			Midday			6 p.m.		
	Dry	Wet	R.H.	Dry	Wet	R.H.	Dry	Wet	R.H.
January	48·2	46·1	84	66·0	55·0	51	56·3	51·5	70
February	49·7	46·3	76	67·6	54·3	49	57·5	51·0	61
March	52·6	49·7	80	74·9	57·9	50	62·7	55·0	59
April	57·2	53·5	77	82·3	62·2	40	68·6	59·1	62
May	63·8	59·6	76	89·4	66·0	62	75·2	64·7	76
June	68·4	64·8	91	94·0	69·0	68	80·3	68·4	86
July	71·6	68·2	92	96·2	71·7	76	82·5	72·2	90
August	73·0	69·7	91	96·0	72·5	80	82·6	73·1	91
September ..	69·4	66·2	89	90·7	70·7	80	78·3	70·1	81
October	64·5	61·9	83	85·8	68·2	76	73·5	66·3	89
November ..	57·1	54·9	85	77·9	62·7	63	65·8	59·8	91
December ..	50·8	48·1	81	69·5	56·8	52	58·2	52·8	69

MALARIA.

The Fayid and Geneifa Areas have long been known as highly malarious. In 1923 the splenic index at Fayid was 91·2 [3]; in 1928, 76·6; and in 1935–36, 33·0 [4].

A glance at the photographs shows that every facility for breeding exists.

To the north in Zones 1 and 2 large "birkas" up to an acre in area are found; those in Zone 1 are more brackish on account of their close proximity to the lake, and those in Zone 2 less brackish owing to irrigation water from the Sweet Water canal.

Further to the south the "birkas" are smaller in extent, but there are considerable areas of marshy land. In the Kabrit area there is a large lagoon at the end of the peninsula but, so far, no breeding has been found in it. There is, however, a dangerous shallow pond at the base of the peninsula in which breeding has been frequently observed.

In Zone 2 throughout the area the irrigation channels running from the Sweet Water canal to the canal road form ideal breeding grounds.

Three species of Anopheles are commonly found in the area :—*A. pharsensis, A. sergenti and A. multicolor*. *A. pharsensis* breeds in pools with vegetation, where the water is more or less stagnant. *A. sergenti* is found in streams where there is some current and shade from vegetation. *A. multicolor* breeds in brackish water clear of vegetation.

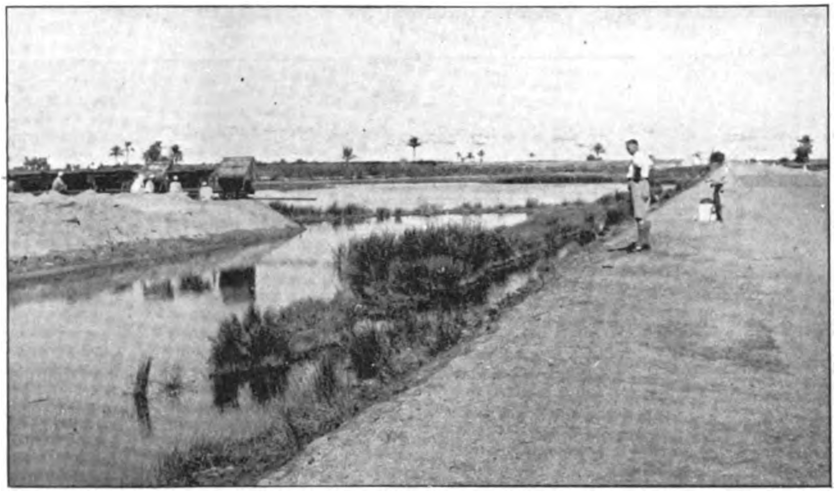
ANTI-MALARIA MEASURES.

In an agreed minute to the Treaty it is stated : "The Egyptian Government in pursuance of the policy which it has already taken in hand for the benefit of the inhabitants of these areas, will take all reasonable sanitary measures for the combating of malaria in the areas adjacent to those where the British forces are situated."

A very complete anti-malaria survey of the area has been carried out and work is in progress to get rid of all breeding places both within the

areas to be occupied by the troops and for a distance of 5 kilometres outside the perimeter of each area.

At Fayid and Geneifa the larger "birkas" in Zones 1 and 2 are being



Filling a "Birka" in Zone 2, Geneifa South. Canal Road on right.

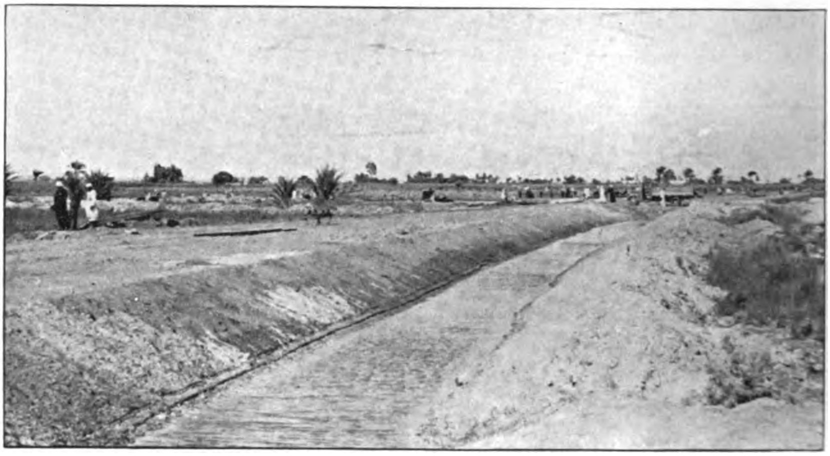
The beginning of a section of the anti-malaria drain. Note the Archimedes screw in foreground.

filled with sand to a level of 1·30 metres—no water-logging exists above this contour. Drainage is not possible in these areas as they are low lying.

As noted above the irrigation channels in Zone 2 provide breeding places for mosquitoes but these channels cannot be shut down until such time as

the inhabitants have been settled in new areas. The removal of the inhabitants will take place once building has begun.

To dry Zone 2 a drain known as the anti-malaria drain will be dug parallel and close to the Canal road but this drain will not function properly until such time as the irrigation channels have been shut down.



A section of the anti-malaria drain completed.

In the Kabrit Area no work will be necessary with the exception of the small area at the base of the peninsula noted above, as the area is situated on a high ridge.

The question whether to mosquito-proof the barracks or not is giving much food for thought. Opinion is very divided and it has been decided to observe closely the incidence of fresh malaria amongst the workmen employed in building before making a final decision.

An Anti-Malaria Sub-Committee of the Main Anglo-Egyptian Treaty Building Committee ensures that the views of both British and Egyptian Sections are fully discussed and this Committee advises on the work to be done.

Once this Sub-Committee ceases to exist, i.e. when the project is completed, a new Committee will be formed so that contact may be maintained between the civil and military on the question of anti-malaria measures within and without the cantonment area.

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[2] Wittenberg, G., and Yofe, J. (1938). *Trans. Roy. Soc. Trop. Med. and Hyg.*, **31**, 549.
[3] Report No. 4, Anti-Malaria Committee for the Fiscal Year, 1927-28.
[4] Agenda of a Meeting of the Anti-Malaria Sub-Committee, Canal Zone, dated June 26, 1936.

Editorial.

DIPHTHERIA.

In 1931 Anderson, Happold, McLeod and Thomson, contributed to the *Journal of Pathology and Bacteriology* a paper on the existence of two forms of the diphtheria bacillus—*B. diphtheriæ gravis* and *B. diphtheriæ mitis.*

The optimistic outlook on the control of diphtheria by toxoid immunization, rapid serum treatment, and isolation of cases, had to be reconsidered in 1927 when a steady rise in the case mortality of diphtheria cases occurred in Berlin. Many of the cases appeared to be quite intractable to serum therapy and the disease seemed to have changed from one causing few deaths, except in very young children, to one in which deaths were equally frequent in children over 5 years of age. In 1929 and 1930 epidemics of unwonted severity were reported from all parts of Europe.

Anderson and his colleagues, in the course of carrying out laboratory examinations for diphtheria in Leeds during eight years, came to the conclusion that two distinct cultural forms of the diphtheria bacillus exist. By using a special tellurite medium they showed that there was a definite correlation of one form with grave and intractable cases of diphtheria, and of the other with the milder cases which react to serum treatment. They gave the name *B. diphtheriæ gravis* to the form associated with intractable cases, and *B. diphtheriæ mitis* to the form associated with the less formidable cases. In a series of 104 cases 63 yielded cultures of gravis and 35 cultures of mitis. There were also six forms which were intermediate, some exhibiting the characters of gravis and others those of mitis. The characters of these intermedius were found to be constant. No mixtures of any of these forms were obtained from cases or carriers.

The colonies of gravis were flattened, lustreless, grey or black on tellurite agar and those formed after thirty-six to forty-eight hours were so characteristic as to be recognizable at sight. The growth consisted of short diphtheroids usually without granules. It actively fermented starch, dextrine and glycogen, and was non-hæmolytic.

The mitis colonies resembled those of Hoffmann's bacillus, but were rather more translucent. The bacilli were usually long with well-marked granules. They did *not* ferment starch or glycogen.

The intermediate forms gave a fine growth on the tellurite medium and did not ferment starch or glycogen. The forms of gravis and mitis and their fermentation reactions, remained unchanged after prolonged culture.

A recent number of the *Journal of Pathology and Bacteriology* contains five papers which deal with some of the important questions raised by this work. Are the three types definite and constant and are the names justified on clinical grounds ?

In 1936 there was a severe outbreak of diphtheria at Kharkoff. and K. Zinnermann and I. Zinnermann carried out a routine investigation of the incidence of the diphtheria types described by Anderson and his colleagues. They examined 254 hospital and 228 out-patient cases. The gravis type was found in 72 per cent of the cases, the mitis in 26 per cent. and the intermedius in only 0·8 per cent. Gravis strains, simultaneously in the throat and nose, were twice as frequent as those of mitis. The gravis strain appeared to have an extended penetration from the primary lesion, while the mitis was more localized to the original site of infection. Laboratory investigations proved the constancy of the types. Three gravis, three mitis, and two intermedius strains were cultured fifty times on tellurite media every three days; all three types remained unchanged. Strains of gravis and mitis were passed through guinea-pigs without any change in their fermentation activities or pathogenicity.

The relation of type to clinical severity was at one time questioned by several observers, viz. Parish, Whatley and O'Brien, but later the close relation between the type of organism and the severity and character of the disease was accepted. K. and I. Zinnermann found that the mitis type is generally the cause of mild infections. All grades of severity are met with in both gravis and mitis infections, but the proportion of severe cases in the gravis series is significantly higher than in the mitis cases. The fatality rate for gravis cases was 13·1 per cent, and for the mitis 1·5 per cent. These figures supported the conclusion that gravis is rightly so named.

All the gravis strains were virulent, but 38·6 per cent of the mitis were avirulent. Having found that the bacteriological and clinical findings at Kharkoff showed a correspondence between clinical severity and bacterial type, which accorded with the experience of the Leeds workers, K. and I. Zinnermann proved the greater pathogenicity of the gravis strains by animal experiment. The gravis strains were more virulent than the mitis when injected into guinea-pigs. Freshly isolated gravis and mitis strains were injected subcutaneously in doses of 100 to 500 million organisms. Out of the 44 strains of mitis, 17 proved to be avirulent even when injected in doses up to 30,000 millions. In 41·3 of the gravis infections death took place within twenty-four hours, while only 11 per cent of the mitis strains killed in that time.

At Kharkoff the gravis strains were more virulent than the mitis because of their increased power of invasion. Invasion of the internal organs took place in 40 per cent of guinea-pigs inoculated with gravis strains and in only 12·5 per cent of those inoculated with mitis. Quite often glucose-fermenting diphtheroids were present in the tonsils: they could be differentiated from genuine diphtheria bacilli by saccharose fermentation, growth in deep glucose agar, and lack of virulence. No support was obtained to the assumption made by Gundel and Erzin that diphtheria bacilli may be excreted by the tonsils.

In view of the greater virulence of the gravis type of diphtheria, the

question arose whether the preparations now in use for obtaining active and passive immunity are adequate against this type. Parish, O'Brien and other workers conclude from their investigations that there is no difference between the toxins produced by the different types and that the usual sera and toxoids are therefore adequate for all cases. K. and I. Zinnermann's work on guinea-pigs showed that precipitated and unprecipitated anatoxin immunizes against toxin of gravis strains and against infection with gravis cultures.

But large doses of living gravis cultures can overcome the active antitoxic immunity which has been developed in guinea-pigs. Antitoxic gravis serum is not superior to the usual commercial diphtheria antisera in protecting guinea-pigs against gravis infections and intoxications.

During 1936 and 1937 Shone, Tucker, Glass and Wright investigated an outbreak of diphtheria in Liverpool. The incidence of the various types of diphtheria bacilli in 2,960 cases was : Gravis 35·7 per cent ; intermedius 26·8 per cent ; mitis, 37·5 per cent. On the whole the incidence of the gravis type was fairly constant, whereas the mitis type tended to supplant the intermedius in the summer of 1937.

There was some evidence of seasonal variation and a tendency for localization of certain types in certain districts, but practically none of selective incidence in age groups. The severity and case fatality rate were greatest with the intermedius types and least with the mitis. Toxic complications were most frequent with gravis and intermedius, and laryngeal complication and pneumonia with the mitis. The case fatality rate in mitis cases was much higher in children under 5 years of age than in older children ; in intermedius cases the rates were higher at all age-periods and especially in older children ; in gravis cases the rate at 0–4 years was very similar to that at 5–9 years. The observed differences between the different types of infection did not appear to depend on differences in the time of admission to hospital or on serum treatment.

Shone and his colleagues consider the view originally put forward by the Leeds workers that the severity of diphtheria depends in part upon the type of organism, though at first disputed, has since received adequate confirmation. Taking the sum total of all reported findings they found that the case fatality rates of the gravis and intermedius cases are practically identical, and both are much and significantly higher than the mitis rate.

There is abundant evidence that the severity of gravis and intermedius infections varies from district to district, and the discrepancy may be partly due to methods of typing. Wilson and Goldsworthy find that type differentiation is most definite when rabbit or guinea-pig blood is used in the culture medium. Colonies of the different types of *C. diphtheriæ* are readily distinguished with the naked eye after twenty to twenty-four hours' incubation on 10 per cent guinea-pig or rabbit blood-agar. The massed growth of gravis strains is heavy with very irregular edge ; with mitis strains it is less heavy with a less irregular edge, and with intermedius it is light and

delicate. A separate colony of gravis type is about 3–4 mm. in diameter, is matt or granular, and has a coarsely crenated edge ; a mitis colony is about 2 mm. in diameter, is smooth, and reflects light like white china, and has an entire edge ; while an intermedius colony is small—one millimetre in diameter—delicate and semi-translucent.

McLeod, Orr and Woodcock consider that the post-mortem demonstration of the lesions produced by the different types is the most convincing evidence of the validity of type-differentiation. In an analysis of 51 post-mortem examinations of patients who had died from diphtheria they found that the gravis type produced a severe and generalized toxic effect on the viscera, associated with hæmorrhagic necrosis of the tonsils penetrating to the deeper tissues and involving the cervical lymph-glands ; whereas in mitis cases respiratory obstruction from the formation of a tough membrane extending down the air passages was the usual cause of death. Intermedius infections give a picture nearer to gravis than to mitis. Gravis and intermedius types were more frequently recoverable from the lungs than mitis. The presence of membrane in the lower air passages appeared to prevent the passage of *C. diphtheriæ* into the pulmonary alveoli. No evidence of *C. diphtheriæ* bacillæmia was obtained. Focal necrosis of the malpighian bodies of the spleen was a frequent concomitant of hæmorrhagic necrosis of the tonsil.

It is generally admitted that the laboratory has little or no place in determining treatment in the first instance, but it has great administrative value in revising the conclusions arrived at on clinical grounds.

Shone and his colleagues state that in their experience the combination of the Loeffler slope and the tellurite blood-agar plate gave the maximum of accuracy with a minimum of work. Their results were very similar to those of Caiger and O'Brien. Altogether 2,919 cases (58·9 per cent) were diagnosed as diphtheria. In 59 of these (2·66 per cent) either no diphtheria bacilli were isolated or those which were isolated proved to be non-virulent. The swab was positive in 57·7 per cent of cases. In Caiger and O'Brien cases 53·7 per cent of swabs were positive.

In a series of 4,960 cases notified as diphtheria, 1,797, or 36·2 per cent. proved not to be diphtheria. Bacteriological confirmation was readily obtained in 97·9 per cent of 2,919 cases of diphtheria, and it is thought that the real error of the methods used was about 0·75 per cent.

Shone and his colleagues consider it worth while to confirm all diagnoses of diphtheria bacteriologically, not so much for purposes of treatment as for administrative reasons ; for the patient who is not suffering from diphtheria should not be exposed to risks of detention in a diphtheria ward in which cross infection is rife and may lead to serious illness or prolonged hospitalization.

The question why the gravis and intermedius produce a picture of greater severity both in life and after death remains yet unanswered.

It has been suggested that the gravis type produces a kind of toxin

different from that of the mitis. This seems unlikely as active and passive immunization are as effective against gravis as against mitis toxin and serum prepared against gravis toxin is no better than commercial antitoxin in protecting against gravis infection. Post-mortem examinations indicate that the histological differences between gravis and mitis are quantitative rather than qualitative. The experimental and histological evidence indicates that the gravis and mitis toxins differ not in kind but only in degree, and the gravis infections are more severe than the mitis because they produce a greater amount of an identical toxin. The gravis types cause a more severe disease because owing to their greater penetrative power toxin is more rapidly absorbed by the host.

The five papers make it clear that the conception of diphtheria as a pure intoxication will have to be modified.

Antitoxin treatment saves many lives, but in this country a case mortality of 5 per cent still remains which may rise to 10 per cent in epidemics caused by the gravis and intermedius types.

It is hoped that the recent researches may stimulate more extensive use of active immunization, which alone can effectively prevent the disease.

Clinical and other Notes.

CYSTICERCOSIS IN AN ATHLETE.[1]

By Major R. R. EVANS, M.D., D.P.H., D.T.M. & H.
Royal Army Medical Corps.

The following notes of a case of cysticercosis that recently came to my notice may be of general interest. In spite of the massive infestation of the musculature, there was no interference with function and it did not prevent the sufferer from becoming an athlete of repute.

Case.—Bandsman R. D., aged 24.

Family History.—Both father and mother are alive and well. His father was a serjeant in the same regiment. He has one brother and three sisters who are also alive and well. He is the eldest of the family. There is no history of fits in any member of the family. His brother is a private in the same regiment: he has been closely examined but presents no evidence of a similar infection.

Personal History and Present Condition.—Born 1914 in Clackmannanshire, Scotland. In 1920 accompanied his parents to Malta where they remained for three years. In 1923 went to Belgaum, India, where the family remained for one year. In 1924 he returned with his parents to England.

Up to this time there is nothing of interest in his medical history and so far as is known to him he had never suffered from tapeworm.

1929: Joined the Army as a boy of 14. Soon after this he was admitted into hospital with a cyst in his neck. This disappeared without treatment.

1933: Had another cyst in the neck, which was removed, but there is no record as to the nature of the cyst.

1934: Proceeded with his regiment to Gibraltar.

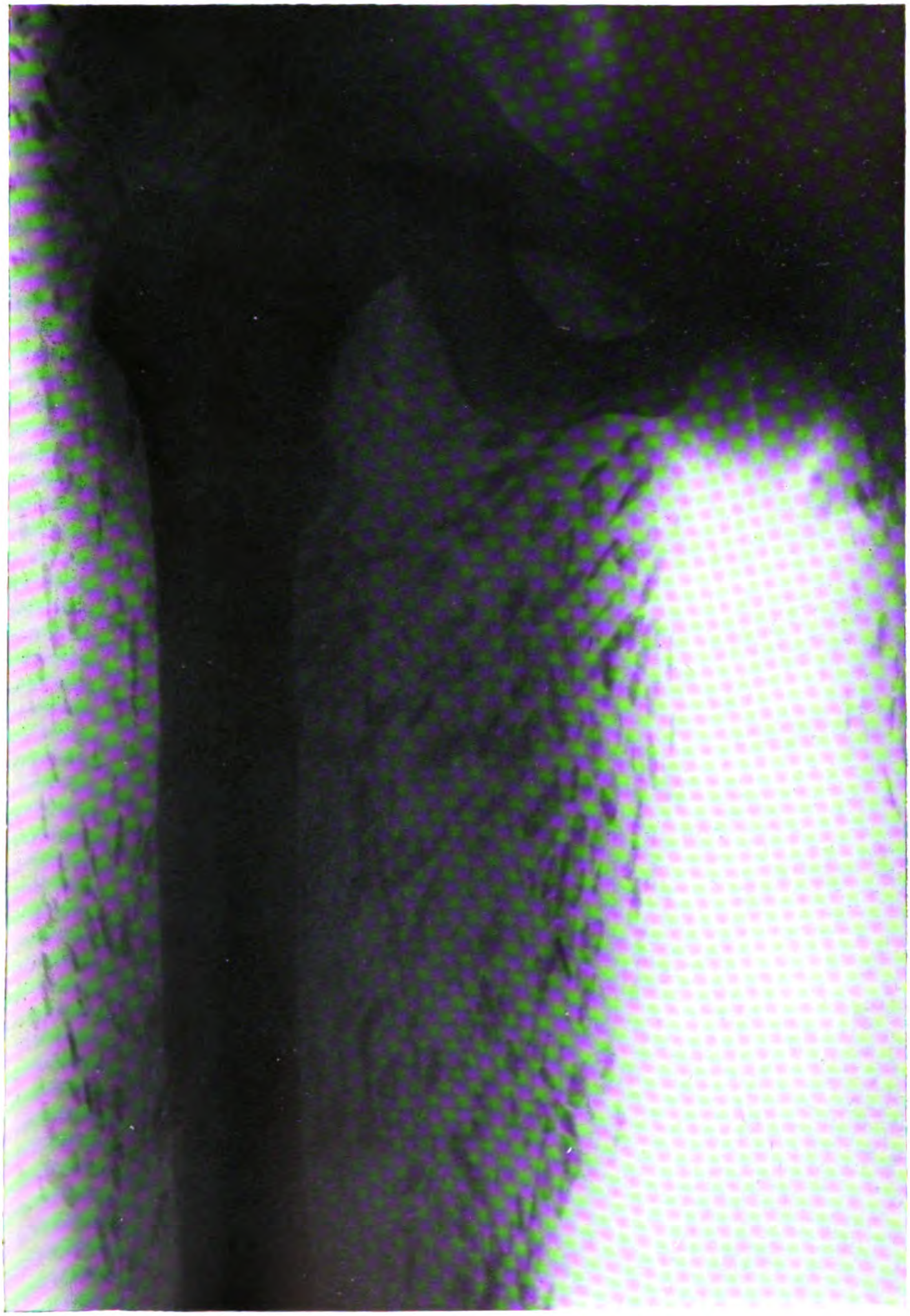
1935: While in Gibraltar he had "some lumps in both arms and in the muscles of the stomach." Two of these lumps were removed and discovered to be cysticerci. After excision of these cysts a lumbar puncture was performed and immediately following this he got an epileptiform fit. He was subsequently invalided to England. He was in hospital for some weeks during which he remained perfectly well, so was not discharged from the Army.

The report on the cerebrospinal fluid reads: "Cells 23 per cubic millimetre, half lymphocytes and half polymorphs; globulin slightly increased."

1937: In August he was admitted into hospital following a fit. He urgently pleaded to be allowed to leave hospital and three days later competed in the Highland Games at Crieff. He obtained second place in the long jump with a leap of 21 feet 5 inches. Just prior to this he was in a team of two which

[1] Republished by kind permission from the *Transactions of the Royal Society of Tropical Medicine and Hygiene*, Vol. xxxii, No. 4, January, 1939.

PLATE I.



Radiograph showing infestation of the muscles of the thigh.

R. R. EVANS : *Cysticercosis in an Athlete.*

PLATE II.

Radiograph showing infestation of the arm, neck and chest.

R. R. Evans : *Cysticercosis in an Athlete.*

won the "hop, step and leap" competition in a gathering of Highland regiments at Edinburgh. He is also a good runner and was placed about fourth in his battalion in cross-country and short distance running. Between 1934 and 1937 he won several medals and cups for running and jumping.

In October he developed another fit. He was lying on his bed at the time and without any warning he suddenly lost consciousness. An eye witness states he threw himself bodily out of bed against his barrack-room box. He was deeply unconscious for about fifteen minutes and was also cyanosed, foaming at the mouth, and there were clonic movements of the head and neck; he did not bite his tongue and there was no incontinence. On recovering consciousness he felt dazed and drowsy and the pupils were widely dilated.

When seen some hours later, clinical examination was largely negative. He was badly bruised on the left side of the head and face. Cysts in the neck were palpable, also various other thickenings in the skin of the back of the neck and shoulders which were perhaps mainly the result of acne.

No swellings could be felt in the arms and legs and there appeared to be no interference whatsoever with function. *Blood-count* was as follows: Red blood cells, 6,300,000; white blood cells, 7,600; hæmoglobin 88 per cent; colour-index 0·7. Differential count: Polymorphs 56 per cent; lymphocytes 41 per cent; large mononuclears 1 per cent; eosinophils 1 per cent; basophils 1 per cent. Wassermann reaction of serum negative. The urine was normal.

X-ray photographs of his body showed a massive infection of the thighs, shoulders, neck and chest (*see* Plates I and II). The cysts in these areas show a varying degree of calcification. No calcified cysts could be detected in the skull.

Owing to the fact that a fit followed his former lumbar puncture and as the diagnosis was already clearly established, puncture was not repeated on this occasion.

He was placed on a nightly dose of luminal and after a period of observation was allowed to leave hospital.

In December, 1937, he was transferred with his regiment to Aldershot. He continued to take luminal each night until May, 1938. Up to the present time (December, 1938) he has had no further fits and has enjoyed perfect health.

His athletic capabilities are as follows:—

Hockey—plays regularly for the band team. *Association Football*—plays regularly for the band team. *Rugby Football*—has recently been tried out for the battalion team. *Field Events*—high jump: 4 feet 8 inches; long jump: 19 feet 10 inches; hop, step and leap: 39 feet 4 inches; discus: 80 feet. *Track Events*—represents the battalion in the 120 yards hurdles and in the relay race (100 by 220 by 440). *Cross-country Running*—has represented the battalion in this event.

The most interesting points in this case are the absence of a history of any symptoms of invasion, e.g. muscular pains, "myalgia," "muscular

rheumatism " headache, fever, etc.; and the man's great athletic prowess: both in spite of such a heavy infestation.

My thanks are due to Lieutenant-General W. P. MacArthur, K.C.B., D.S.O., O.B.E., K.H.P., M.D., F.R.C.P., D.T.M. & H. for his advice and the interest he has shown in this case, and to Colonel G. F. Dawson, M.C., D.D.M.S., Scottish Command, for permission to send these notes for publication.

AN INTERESTING CASE OF RABIES.

BY CAPTAIN J. SHIELDS,
Royal Army Medical Corps.

THIS case is recorded because it shows some unusual features and is of interest in that it occurred after and in spite of antirabic treatment, which may have exerted a modifying influence on the form and course of the disease.

Private X, aged 26. Indian service three years.

History.—Patient stated that he had been licked by his rabid dog on February 22, 1938. He denied having been bitten or scratched and showed no fresh cuts or abrasions. He was placed on antirabic treatment on February 28, and received 2 c.c. antirabic vaccine daily for seven days.

March 13: Patient complained of headache, nausea and vomiting.

March 14: Detained in hospital. Vomited three times after feeds and complained of an occipital and frontal headache.

March 15: Occipital and frontal headache still present, not relieved by aspirin; vomiting after feeds, nausea and general malaise still present.

Pyrexial period from March 14. Maximum temperature 104° F., pulse 100 (on March 14). Defervescence from March 14.

March 16: Admitted to hospital.

General Condition.—Temperature 102° F., pulse 88. Patient of good physique. Looks depressed and is rather reticent. Face flushed. No wounds or abrasions on body surface. Tongue slightly coated with white fur. Tonsils normal. Teeth normal.

Alimentary System.—Liver and spleen not enlarged. No abdominal pain or tenderness.

Respiratory and Circulatory System.—No appreciable disease.

Cranial Nerves.—No appreciable disease.

Tactile Sensation.—Not impaired. No paræsthesia.

Motor Tone and Power.—Normal on both sides.

Plantar Response.—Flexor.

Abdominal Reflexes.—Present and equal.

Deep Reflexes.—Knee-jerks, ankle-jerks, jaw-jerks and tricep-jerks present, right and left.

Pupils.—Equal and normally reacting to light and accommodation. No nystagmus.

Blood smear.—Negative for malaria parasites.

Blood-count.—Total red blood cells 4,500,000 per cubic millimetre. Total white blood cells 14,000 per cubic millimetre. Differential count: Polymorphs 67 per cent; lymphocytes 31 per cent; eosinos. 1 per cent; hyalines 1 per cent.

Urine.—Reaction: Alkaline, specific gravity 1035, albumin nil. Sugar present. No casts.

Treatment.—Bed, fluid diet, A.P.C. 10 grains t.d.s.

March 17: Isolated. Patient passed a very restless night and complained of double vision at about 1 a.m. Temperature (axillary) 99·8° F., pulse 70 (6 a.m.); temperature (axillary) 99° F., pulse 76, respirations 24 (10 a.m.).

8.30 a.m.: Patient complained of periods of distressed respiration and was unable to swallow fluids for more than a moment. He was capable of answering questions quite intelligently. Salivating slightly.

He was able to move his eyes in all directions. Had diplopia. Convergent strabismus present. Pupils contracted, equal and not reacting to light. No nystagmus. Sensory function not impaired. No paræsthesia. Motor power normal. No wrist or foot drop. Muscular tone increased. Plantar response flexor. Abdominal reflex sluggish (or ? absent). Knee-jerks slightly more alert than on March 16.

2 p.m.: Periods of restlessness of longer duration. Respiratory distress gradually becoming worse. Deglutition becoming progressively more difficult. Pulse 104, respirations 30.

5 p.m.: Inclined to be violent: shouting and threatening the orderlies.

10 p.m.: Very restless. Breathing jerky, distressed and stertorous owing to tonic spasm of laryngeal and pharyngeal muscles; saliva being expelled with the forceful blowing expirations. Completely unable to swallow.

10.40 p.m.: Patient died. I think the unusual features of this case are nausea and vomiting, convergent strabismus and immobility of the pupils, glycosuria, though I have seen this latter symptom mentioned in one text-book, and finally the shortness of the incubation period. In this connexion it is relevant to trace the history of the first dogs to die during the outbreak.

From the table given below it will be seen that the incubation periods of all four were short. Even Dog B, which had antirabic inoculation, only lasted twenty-one days.

	Dog A	Dog B	Dog C	Dog D
Bitten	February 23	February 23	*Not known	*Not known
Showed symptoms ..	March 6	March 13	March 3	March 8
Removed to kennels ..	March 7	Not known	March 5	March 9
Died	March 9	March 15	March 7	March 16

* Late in February. Exact date unknown.

The virus was obviously very strong, possibly by passage through a number of dogs, and this probably accounts for the fact that the patient died in the stage of excitement without having passed into a condition of coma.

Echoes of the Past.

WITH THE KITE BALLOONS IN FLANDERS.[1]

BY DOM BASIL WHELAN, O.S.B.

NOTE BY LIEUTENANT-COLONEL T. J. WRIGHT, R.P.

C. B. Whelan, Lieutenant, Leinster Regiment, 1915. *Seconded to Kite Balloons as an Observer.*

After the war he went up to Oxford, took an excellent degree (History); went over to the Roman Catholic Church and is now a Benedictine monk.

IN these days of war books and of general interest in even the lesser incidents of the War, it may be permissible here to recount a personal experience which sheds a light on one of the less familiar activities of the fighting forces. I refer to the occasion on which the writer owed his life to a parachute, when, in fact, he had to make what the more sensational papers would truly call " a leap for life " from a destroyed balloon at a height of some 4,000 feet.

Had you been at Ypres (that city of stirring events) on a certain March morning in 1918—and perhaps you were—you would have witnessed what I am about to relate. At that time, as a result of the terrible struggles which had continued from July to Christmas of the previous year, and are generally classed together as the Third Battle of Ypres, the front line in " the Salient " ran from Passchendaele to Broodeseinde (i.e. along the top of the terrible ridge from which the Germans had previously for so long dominated the whole countryside), and consequently what we may term the " Balloon Line," which always ran parallel to, and some three miles behind, the front line, in those days passed through Ypres itself. As all old soldiers will remember, there was a " sausage balloon " stationed roughly every half mile along the whole length of the allied front, and the sight of this line of gasbags floating against the sky was one of the most familiar sights of the war. The particular balloon concerned in this narrative was stationed some three-quarters of a mile to the south-west of Ypres.

All the world remembers that it was on March 21, 1918, that the tremendous German attack began on the Western Front, the attack which was intended to end the war. As it turned out, the locality selected for the battle was down south of the Somme in the Bapaume-Peronne neighbourhood, and so we in Belgium were not at first directly affected ; but in the late War any attack on a large scale had repercussions up and down the front for miles in each direction, for the attacking side would almost invariably make feint assaults which were intended to deceive as to the locality chosen for the main attack. For months past everyone had known that a great German " push " was about to be made, but the scene of it was not known ; and so we were not surprised at Ypres when we noticed from the beginning of

[1] Reprinted, with additions, from *The Month* by kind permission of the Editor.

March signs of increased activity in the enemy opposite us, one of which signs took the form of active hostilities against our balloons. No doubt the Germans argued that if they showed an intention of driving our balloons out of the sky in this district it would lead us to believe that they had something which they did not wish observed; in other words, they were preparing an attack there.

And so it happened that whereas our observers had long been accustomed to being left unmolested save for an occasional German aeroplane prowling in the vicinity, life now became for them a thing of storm and stress and no little excitement. Every morning now when the balloons went up (and in fine weather they had to be up from dawn till sunset) they would be harried in various ways throughout the day. Either flights of German 'planes would seize a favourable moment in the absence of any of our machines and, dashing across the lines, would shoot down in flames three or four of our balloons before returning to their own lines; or else a long-range gun would persistently shoot at them with shrapnel. And this last had been the fate of our Section every day for the past fortnight. Now it is not a pleasant sensation to be perched some 4,000 feet in the air in a stationary and defenceless balloon that forms an excellent target for the painstaking German, and to be peppered with shrapnel all day, and accordingly we made considerable efforts to induce some of our artillery to use some of their superfluous energy in silencing the particular gun that was annoying us. We soon christened it "Persistent Percy," and on going up each morning the eyes of the observers were wont to stray with exaggerated unconcern to that distant spot on the south-eastern horizon where it was known "Percy" had his abode, for by this time we had succeeded in locating the brute. Unfortunately, however, it was too far back for any of our guns then available to reach it, and consequently it continued its attentions unmolested, though our aeroplanes attempted on at least one occasion to bomb it in its lair.

And now, in order that the reader may understand the events which follow, I must explain in a few words the nature of the work carried out by the balloons, perhaps the most interesting and fascinating "job" in France. The chief work of the balloon observers is that of "spotting" the German guns that are firing, locating by their flashes their exact position on the large map that hangs in the basket, and 'phoning such information to Corps Headquarters. Every evening each Corps published a list of the enemy batteries thus reported to be active (every battery had its own name or number), together with their positions, and arrangements were generally made between the artillery and either aeroplanes or balloons to deal with them effectively next morning. For this was the second branch of the observers' work: the directing of artillery "shoots." On such occasions the observer, having picked up his target through his field-glasses, would 'phone down that he was ready, the balloon telephone exchange on the ground passed the message to the battery, the gun fired, and the fact was reported by the same means to the balloon. The time occupied in flight by the shell

being known to the observer, he would at the right moment closely watch the target (generally a German battery or a " pill-box "), observe the burst of the shell, and 'phone down how much short or " over " it was, and how much to left or right. These corrections would be at once passed on to the battery, which would make the necessary alterations, and then the gun fired again. So the shoot proceeded. Such was the detail of a work the nature of which was little known even to most soldiers. Frequently the observer would be conducting as many as three such shoots simultaneously with three widely separated batteries, and it was in such cases that knowledge of the time of flight of the shell was of special importance to the observer.

This, then, was the nature of the work we had been carrying on as usual during the early days of March, " counter-battery work," as it was technically called, though of course observation of any other activities (trains in motion, columns of men marching, etc.) would also be noted and reported. Each day, however, as the month wore on, our balloon attracted more and more attention from our friends the enemy although, curiously enough, those on either side of us were hardly ever molested. Possibly our position almost directly behind Ypres made us specially prominent. In any case when, on March 18, it came to my turn to spend the day in the balloon, I fully expected a certain amount of fun to occur. It did !

That morning I took up with me a serjeant who was training to become a qualified observer (95 per cent of the observers were officers), and since at that early hour (shortly after sunrise) there was still a fair amount of ground mist hanging about, we went up rather higher than usual so as to be able to pierce it the better, and we gave the order to stop letting up when we had reached about 4,500 feet, which was about a thousand feet above the usual height at which we worked. It was a beautiful morning, and the front seemed singularly peaceful. A few shells were falling around Gheluvelt away up the Menin Road, and the Germans were shooting occasionally into the St. Julian-Langemarck area, otherwise there was perfect peace, and from that height both armies seemed to be asleep. The morning silence was broken for us only by the droning of engines as our 'planes made their early-morning trips over the German lines, glinting as they turned in the bright sunlight. Our neighbouring balloons to right and left were also up, and soon there was a string of them across the western sky as the news got passed down the line by 'phone that those in the air had reported the visibility to be good. Six miles to the east a few German balloons were also to be seen, but they were seldom as numerous as ours.

By all appearances we were in for a hard day's work, for the weather was perfect and the visibility excellent, and before long we had two " shoots " on hand, for which I was observing through the glasses, while the serjeant, crouching at the bottom of the basket so as to be sheltered from the wind which made telephoning difficult, passed down my observations to the two batteries concerned. All was going well and so far we had been left in perfect peace. Unfortunately this halcyon state of affairs was not to last

long ; it seldom did. I had my eyes glued to the distant target and my whole attention was engaged on the matter in hand, when suddenly there was a resounding *bang* ! followed by a weird whistling noise as fragments of metal rushed to earth. Percy had started at last ! I looked up and there was a ball of smoke in the air about 100 yards away and some distance above the balloon. It was not bad for a first shot. To make sure, however, that it really was our old friend and not a new acquaintance I turned my glasses for a few minutes to the south-east and was soon rewarded by seeing a tiny flash that looked about the size of a pin-head appear for a moment away on the horizon in the neighbourhood of Wervicq. Now we knew by experience the " time of flight " of the shell sent by our old enemy, and I ticked off the seconds on my watch. Sure enough, at the precise second there was another and a louder *crash* ! and a shell burst this time below the level of the balloon and still short. There was no doubt that " Percy " had started his day's work.

Now it was an understood thing that the British balloons never hauled down when they were shelled, owing to the dislocation of work which would ensue (I believe there was an order against it) ; although the first few shots by one of our long-range guns at a German balloon were nearly always sufficient to cause it to be hauled down. Presumably the Germans were more careful with their material (human and mechanical), but it resulted in their balloons being thus frequently put out of action and much of their utility lost. Accordingly, we were clearly in for a day of shelling, and in such circumstances there is only one thing to be done, and that is to move the balloon in so far as may be possible. It is not likely to prove effective, but it is the only chance. This moving can, of course, take the form of simply ascending higher or of being hauled down lower, but there is another and generally a better way. The balloon is attached by a steel cable to a " winch," which is a motor chassis with a special type of engine built on to it. It is this engine which, after the manner of a donkey engine, operates the drum round which the cable is wound, so that to let the balloon up the engine is run in one direction, and to haul it down it is reversed. Now it was customary to have the winch whenever possible stationed on a road running roughly north and south, i.e. parallel to the trenches, the object being to make it possible to move the balloon *sideways* in case of shelling, the winch being run gently along the road with the balloon in the air several thousand feet up, and thus the whole concern was moved wholesale, as it were. This was generally considered better than running east and west, as being more likely to disturb the enemy's shooting.

On this particular occasion, however, we had no road running north and south, and the track on which the winch stood ran directly towards the German lines. Accordingly I gave orders for the balloon to be hauled down 300 feet and to be run about a quarter of a mile along this track as being the best that could be done, and the only course thenceforth was to keep altering the position from time to time and so to render Persistent Percy's task

at least slightly more difficult. Then we proceeded to get on with our work.

Unfortunately, so also did the German gunners, and our task continued to a constant succession of ear-splitting explosions at absolutely regular intervals in our immediate vicinity, so that it became quite plain that we must either haul right down and abandon the job for the day, or else prepare for the worst. In the circumstances, since from the point of view of visibility it was the finest day we had had for many weeks, and in view of the fact that we were in the middle of two satisfactory " shoots " which must have been causing the enemy considerable inconvenience, to haul down was unthinkable. Accordingly, we looked to the fastenings of our parachutes, I gave instructions to the men on the ground to continue to move us about at intervals, and we prepared to carry on. Incidentally, we thereby gave great satisfaction to the miscellaneous thousands on the ground who were casually watching the fun, for the spectacle of a balloon being " shot up " was, for some mysterious psychological reason, invariably immensely popular with " the troops," and always proved a prime attraction. I remember thinking so myself in my infantry days, but my thoughts on the subject had now undergone a decided change.

As it happened, however, the German gunners at that moment saw fit to desist from their efforts for the present. No doubt breakfast had been served or the mail had arrived. At any rate, there was an interval of blissful peace for us and we got on with our work. After about half an hour both shoots had been completed and we had a moment of leisure. At such times I always used to revel in being up in the balloon. There was something extraordinarily exhilarating in being 4,000 feet up in the fresh air with always a strong wind blowing at that height even on the calmest day, and the earth spread out below one. There was a feeling of detachment from the war and even from life itself, as though one were a visitor from some other world altogether, or at least one had the feeling of being a privileged onlooker in the front row of the dress circle. Even one's sympathy with those who were plainly being shelled on the ground below could not damp this feeling which was a mingling of excitement and sheer romance. And this romantic element was increased a thousandfold in my own particular case by reason of the locality in which our balloon was stationed. For here we were in one of the greatest moments in all history, at the height of the Third Battle of Ypres (when I first joined that Section) and looking out over what was surely the most famous battlefield in the world. Right in front of us stretched the Salient, from Poelcappelle on the left down to St. Eloi on the right, and between these two were to be seen Wieltje, Becelaere, Hooge, Inverness Copse, Shrewsbury Forest, Zandvoorde, Hill 60, and a score of other places bearing world-famous names, while only a few miles off to the south there stood up the Messines Ridge and Kemmel Hill. Truly one felt singularly privileged and fortunate to be so placed. But in this wide scene our own activities were confined to the V-shaped sector bounded by the

two diverging straight lines formed by the Menin Road on the right and the Ypres-Roulers railway on the left which, starting from a common point (the famous " Hell Fire Corner ") just in front of Ypres, ran south-east and north-east respectively.

Such was the setting of the scene that sunny March morning, and as I gazed on it again I fell to musing on the stirring scenes it had witnessed during the past three and a half years. But in war one seldom has time to muse, and before long we were roused once more to a sense of the present by a shattering explosion in our rear. We sighed patiently and looked at each other. Evidently the German breakfast was over or the letters read, and Fritz was anxious to resume earning his pay. Unfortunately he had evidently profited, like the careful fellow he was, by the shooting in which he had indulged earlier in the morning, and had made the necessary corrections, for after only two or three more shots one of his efforts burst directly overhead though rather too high. None the less the shot had been close enough to make it probable that the upper fabric of the balloon had been damaged, and from the basket we had, of course, a very restricted view of the gasbag itself. But we watched it attentively and after a few minutes it was evident that our suspicions were well founded, for even from our position it was plain that the bag was beginning to sag ominously and it was clear that it must be badly punctured on top, *how* badly it was impossible to discover.

In the circumstances I had no choice but to telephone down for the balloon to be hauled down at top speed, for there was a distinct possibility that if the gas were rushing out to any great extent she might well collapse before we reached the ground. Immediately after telephoning we felt the preliminary jolt that told us they had begun to haul us down. Unfortunately the work of hauling down is a lengthy one and cannot be done expeditiously. If my memory serves me right it takes something like twenty minutes to be hauled down some 4,000 feet. Consequently it was highly problematical whether she could last out that length of time and, indeed, after we had come down about 600 feet the gas-bag looked so flabby (quite half empty) that I asked the observers on the ground whether they thought there was a chance of coming down safely, for they had a better view of the aspect of the balloon as a whole. The cheery answer that I got was that it was " very doubtful," and that meant there was but one thing to be done.

At this point I may mention that in those days, in the event of having to jump with a parachute, one could by no means be sure of the parachute opening. Cases were known of observers having leaped out only to crash to earth 3,000 feet below ; and this important consideration, coupled with the fact that neither my companion in the basket nor I myself had ever performed a parachute jump, explains why we had not already jumped at the first hint of danger but preferred to remain in the basket so long as there was a chance of thus coming safely to ground. Parachute jumping was not encouraged by the authorities as a form of sport, there was no practice or training given

in this form of athletic exercise and hitherto neither of us had had occasion to jump for our lives. It looked as though this omission were now about be to rectified.

I now broke the news to my companion in misfortune, and the announcement was not greeted with enthusiasm. As for myself, I was no more delighted than he by the prospect, and I remember thinking in those tense few moments that this was the first time that I had ever been faced squarely with the imminent prospect of death. It is true I had many times been under heavy shell-fire in the trenches, but somehow that seemed different. There one was one of a crowd and had a good chance of being missed. In this case, however, one was practically alone, and death seemed to be aiming directly at oneself, although in reality the odds were that the parachute would open quite satisfactorily. In any case there was no choice, for it was manifestly much too risky to remain in the basket since it might at any moment crash to earth beneath our feet.

Being the senior of the two in the basket, it was my duty to jump last and to see my companion out safely first. As it happened he required a certain amount of persuasion as to the necessity for taking this step and was inclined to argue that we could safely stay where we were. In view, however, of the opinion telephoned from the ground this was no time for argument—every moment I expected the whole contraption to collapse in mid-air, and eventually I told him definitely to get overboard. Accordingly he took off the field-glasses which were slung round his neck, while I did the same with mine, clambered on to the edge of the basket and after a moment's hesitation disappeared over the side. Peering over after him. I was relieved to see his parachute open after a few seconds of sheer dropping and he was evidently quite safe.

Now came my own turn. I admit that the palms of my hands went clammy and cold at the prospect (they still do at the recollection of that moment), but there was no time to be lost. Now I know that to some hardy souls jumping overboard with a parachute was merely an enjoyable experience and that some have been known in such circumstances to make their exit from the balloon by taking a " header " into space as though they were diving into a bathing pool, but I lay claim to no such valour. What actually happened was that I clambered carefully on to the edge of the basket (illogically enough taking great care lest I should slip and fall overboard. which as a matter of fact would probably have been the best thing to happen). and then let my feet dangle in space while I clung on with my hands to the basket which was now above me. Then I shut my eyes tight and most gingerly let go first with one hand and then with the other and promptly fell through space like a stone. How far I thus fell before the parachute opened I do not to this day know, probably about 300 feet, but I know that after that fall the most rapid descent in a lift fails to make me feel that I have " left my inside on the top landing." Needless to say that part of the fall was in reality over in a few seconds, though it seemed longer, and then

I felt a terrific jerk at my shoulders as my fall was abruptly pulled up sharp, and I realized with relief that the parachute was at last open and I was floating gently down to earth, though still nearly 3,000 feet up, and swaying from side to side like a giant pendulum.

The subsequent part of the proceedings is really quite a pleasant experience, and one's only anxiety is as to the nature of the ground at the place of landing, for of course no control of direction is possible. In my case this was a not unimportant matter, for the position of the balloon when we had left it had been about three-quarters of a mile south-west of Ypres and I was being blown directly towards the city. Now, as is well known, Ypres is surrounded by a moat which then, as now, was full of water (and other things), and it flashed into my mind as I was coming down, that only a few weeks previously an unfortunate balloonist who had also had to parachute in this neighbourhood had landed in the middle of the moat, and being weighted down by his heavy flying clothing had been dragged down and was actually drowned. Even as I remembered this I noticed that I too was heading straight for the moat and was now at no great height. Should I, or should I not, succeed in clearing it ? It looked as though it was going to be a very near thing. I came lower and lower, falling at a fairly fast rate as there was little wind blowing, and to my relief I passed over the dreaded moat though little more than 30 feet up at the time.

Even then, however, life was not without its worries, for two facts which I have already mentioned were becoming increasingly important : one was that I was coming down at a considerable pace and was already wondering how hard I was going to hit the earth, and the other was that I was obviously about to land in the middle of the ruined city. Neither of these considerations formed a comfortable matter for reflection, for a city means walls, and walls mean a nasty knock and possibly broken bones. Every parachutist prays for an open space on which to land. Well, down I came, skimmed over some telegraph wires by inches (I knew a man that had been held up in such wires to the huge delight of passers-by, and it took some twenty minutes to extricate him), missed the remains of a tall chimney by a similar number of inches and, as I had expected, finished up by crashing into a high and remarkably solid wall. At the last moment, when I saw the collision was unavoidable, I put out my right foot to save myself, and the consequence was that my foot came with all the momentum of my fall up against the wall and at the same moment I felt an agonizing pain in my ankle as I bounded off the wall and fell on the ground on my back.

At least I was at last on the ground, and my first care as I lay there was to draw out the sharp knife which we always carried for such an emergency and with it to sever the stout rope which still connected me to the parachute. The point of this is that after landing one often gets dragged along the ground a considerable distance through the wind catching the umbrella-shaped parachute, and it is therefore wise to cut oneself free at once. This done, I tried to get to my feet but promptly collapsed with a

yell, and it was several months before that foot touched the ground again. It was in fact plain that my ankle had been fractured and had had decidedly the worst of its encounter with the wall. However, my downward career in the parachute after the manner of an angel from the sky had, of course, been witnessed by thousands of people on the ground, and so I had not been many seconds lying there before I was surrounded by an excited crowd clamouring, in about six different dialects of English and Scotch, to know what had caused the jump, whether I was hurt, and a score of other things. They were all anxious to help, and I soon found myself carried into the nearby dugout of a hospitable Artillery major who insisted on them laying me upon his bed and within a few seconds was watching me pour his whisky down my throat. Apart from a certain shakiness and the injury to the ankle, I was perfectly all right.

Meanwhile, as was always the case when anyone had had to "jump," one of the R.A.F. cars attached to our Section had set out when it was seen where I was likely to land, and it soon came dashing along after the manner of a fire-engine. By the time it had arrived my mind had been relieved by the sight of my companion in distress, the serjeant who had jumped with me, walking past the doorway.

"All right, Serjeant?" I shouted at him.

"Yes, sir," he called back, "they couldn't do *me* in."

However, I guessed a "spot" would not come amiss to him, and he gladly accepted it neat, and five minutes later the car had landed us back at the balloon camp and I was being helped to hop on one foot to my hut. On the way we had passed the collapsed balloon, and I was interested to note that we had done right to jump, for it had ultimately collapsed while still some 400 feet from the ground and now lay at the end of the cable that distance from the winch. Decidedly we had had a fortunate escape. I may say that within the hour it had been patched up, refilled, and was again in the air with fresh observers, "spotting" the Germans, a fact which must have caused them no little chagrin. There is little else to tell. A few weeks in hospital at the Base (where we were badly bombed) and at Manchester, followed by four months' treatment in a luxurious convalescent home in the Lake District together with a permanently weak ankle, were the material results of the experience, and I got back to France in October, a few weeks before the Armistice, only to be shot down again the very first time I went up—this time by four German aeroplanes and in flames. But that, as Kipling says, is another story.

Current Literature.

SORLEY, E. R., Surgeon-Commander, R.N. **The Use of Gas-protective Clothing in Singapore.** *British Medical Journal*, February 25, 1939.

Following the publication of Crowden's work in the JOURNAL OF THE ROYAL ARMY MEDICAL CORPS, Lieutenant-Commander Douglas and the author co-operated in pursuing similar investigations in the climate of Singapore.

The clothing chosen for the tests was: (1) An ordinary gas-protective suit with hood and respirator; (2) a suit of wettable double cellular cotton with a hood of the same material and respirator worn over the gas-protective clothing; (3) a suit of white surgical lint with a hood of the same material and respirator worn over gas-protective clothing. The work undertaken was exactly as described by Crowden. The subjects were average members of a fighting Service personnel.

The best results were obtained with a subject wearing No. 3 clothing; the man worked continuously for twenty-five minutes and showed no signs of fatigue; in a second test the man performed an hour's work with three stoppages amounting to twenty-seven minutes. The author repeated Crowden's experiments and worked for twenty-five minutes without being seriously tired. He concluded that continual wetting of an ordinary gas-protective suit during muscular efforts enables work to be performed, diminishes discomfort and lessens the danger of heat exhaustion. Indeed, the standard and persistence of the work displayed by subjects who wore no external water-retaining layer scarcely fell below that shown by other workers who wore water-retaining material. He considers that the ordinary gas-protective suit can be made practicable for use in the climate of Singapore, provided it is kept continually wet during use. Wetted cellular cotton and surgical lint materials have some value as cooling agents when worn over protective clothing, but probably have no advantage over the wettable and water-retaining fabric adherent to the gas-inpermeable layer as described by Crowden. Cotton and lint clothing increase the time of dressing, and undressing, and would be apt to perish and shrink after boiling.

SHOPE, R. E. **Swine Influenza.** *J. Exp. Med.*, 1931; *Science*, 1929; *J. Exp. Med.*, 1937; *Lancet*, 1939.

In 1931 Shope showed that two agents were necessary for the development of swine influenza, viz., *Hæmophylus influenzæ suis* and the swine influenza virus. Pig disease spreads rapidly by contact during the winter but disappears in summer: at this period the virus has not been detected in the herds. Shope has now shown that in the inter-epidemic periods the virus may persist in lung-worms of which two species infect pigs—

Metastrongylus elongatus and *Chærostrongylus pudendotectus.* The worms inhabit the bronchioles at the base of the pigs' lungs and embryonated ova are passed in the fæces, and are ingested by earth-worms in which they develop; after weeks on grass the earth-worms may be eaten by pigs and the liberated lung-worms then find their way into the pig's respiratory tracts. Shope showed that influenza—proved genuine by recovery of the virus—could be induced by intramuscular injections of *H. influenzæ suis* into pigs previously fed with infected earth-worms. The first infection of bacteria did not cause the disease; the pig had to be sensitized to the microbe, when subsequent injection gave rise to the results required. Injection of the hæmophylus into pigs not fed on infected earth-worms never produced the disease; nor did this follow the ingestion of the infected worms without the provocative injection of bacteria. The role of *Hæmophylus suis* is probably not specific, since Shope has produced influenza by a single intrapleural injection of calcium chloride into suitably prepared pigs.

Proof that a virus can be carried by an intermediate helminth would be of great importance to the epidemiologist and no doubt Shope's experiments will be repeated. Unfortunately he has been unable to demonstrate virus in presumably infected earth-worms or in the lung-worms of swine thought to be ripe for provocation.

These results with swine influenza may well prove important for epidemiological studies in America and may give a clue to the distribution of the disease in other countries. They make us speculate once more where human influenza virus persists in inter-epidemic times. Our knowledge of human helminths does not render it very probable that the results will be applicable to disease in man.

BARDSLEY, DORIS A. **A Comparative Study of Coliform Organisms Found in Chlorinated and in Non-Chlorinated Swimming Bath Water.** *J. Hygiene.* 1938, v. 38, 721–31, 3 figs. [15 refs.]

Swimming bath water was examined by the coliform test, 339 samples from chlorinated and 47 from non-chlorinated baths in Manchester. A number of experiments were made to test the effect of chlorine on certain types of the coliform group.

The open-air pools are not treated, but submitted to periodic scrubbings with chloride of lime. The indoor bath water is filtered and chlorinated on lines drawn up in the *Purification of Water of Swimming Baths.* (Ministry of Health, 1929.)

The presumptive coliform test gave positive results in 160 of the chlorinated and 30 of the non-chlorinated samples, but the number of tubes positive is not clearly specified for all samples.

Further examination of the presumptive positive samples revealed that *Bact. coli* was isolated almost as often from chlorinated as from non-chlorinated bath samples (over 70 per cent), but intermediates and *Bact. aerogenes* were more frequently found in chlorinated samples, particularly the latter,

which occurred in 70 per cent of chlorinated compared with 43 per cent of non-chlorinated samples.

Despite the fact that 89 per cent of the 2,400 coliform strains isolated were from the chlorinated series of presumptives, intermediates and *aerogenes* were again shown to be more common in chlorinated pools.

It is impossible to preclude the chance of soil origin of intermediate-*aerogenes-cloacæ* (I.A.C.) organisms in the open-air waters, but there is little doubt that these types in the indoor pools come from human contamination.

A series of experiments was carried out by the author on the chlorination of suspensions of pure cultures of coliform organisms in distilled water. The initial concentration of bacteria was enormous, far in excess of the coliform content found in the bath samples. After mixing, the chlorinated suspensions were kept at 22° C. (approximately the temperature of the swimming bath water) for several days, and bacterial counts made from time to time. A dose of 0·1 part per million had little effect, but 0·3 and 0·5 part per million caused a rapid reduction of organisms, counts of *coli*, intermediates, and *aerogenes* falling steadily for forty-eight hours, until all trace of chlorine had disappeared. A gradual rise in count followed but did not continue indefinitely, and never reached the numbers in the original inoculum. *Bact. aerogenes* required four to six days to reach its maximum, which was one-ninth of the initial content ; intermediates required seven to nine days to reach a maximum of one-thirtieth of the original ; and *Bact. coli* required twelve to fifteen days to reach one-hundredth of the original.

The author quotes the results of several workers, showing the importance of intermediates and *aerogenes* as intestinal congeners, and so explains their presence in swimming bath water. The chlorine experiments did not reveal any marked difference in sensitivity of coliform types (except that the recovery time and number were greatest with *Bact. aerogenes*), and so did not explain the greater frequency of I.A.C. in chlorinated pools.

It is suggested, owing to the practical difficulties of chlorination, that portions of the bath are but feebly disinfected and in these areas the difference in sensitivity between the coliforms will have an effect. This difference, however, is so slight that *aerogenes* rarely becomes dominant, but shows as an increase in proportion of *aerogenes* survivors to *coli* survivors in chlorinated compared with non-chlorinated swimming baths.

E. WINDLE TAYLOR.

Reprinted from "Bulletin of Hygiene," Vol. 14, No. 3.

ROSE, MARY S. & VAHLTEICH, Ella M. **A Review of Investigations on the Nutritive Value of Eggs.** *J. Amer. Dietetic Ass.* 1938, v. 14, 593–614, 7 figs. [94 refs.]

A number of experiments are reviewed, showing the nutritive value of egg in the diet. Rats on a diet of 70 per cent dried bread and 30 per cent whole egg powder showed excellent growth and health and reproduction, similar to those of animals on 30 per cent dried milk. When lean beef was

given *ad libitum*, instead of egg, there was initial good growth followed by loss of weight, bad health, and early death. Rats fed on diets resembling those of nursery-school children containing various amounts of white cereal, milk, vegetables and fruits, fats, sugars and meats, showed good growth but failure of lactation. On the medium cereal diet, part of the meat and fat were replaced by the equivalent of one egg a day in a child's diet (about 3 per cent total calories). This resulted in better gains in weight, improved lactation, and earlier maturity (average age at first litter without egg being 105 days, with egg 94 days). These experiments showed that a diet already good for growth could be improved more by substitution of egg for meat than by an increase in vegetables. Sixty children were kept on a diet in which 36 per cent of the calories came from milk, 30 per cent from cereals, and 20 per cent from vegetables and fruit. They were divided into two groups, one receiving an egg daily (increasing the iron intake by 10 per cent), the other its equivalent in calories in the other foods. At four-month intervals, blood tests showed 40 per cent of the children receiving egg to have a hæmoglobin value of 12·5 grammes per 100 cubic centimetres of blood, while only 22 per cent of the children not receiving egg reached this level. The difference in hæmoglobin content was more marked in the second than in the first year of feeding. Similar results were obtained when liver was used instead of egg, although in anæmic rats twice as much iron in the form of liver was needed to induce a given amount of hæmoglobin regeneration as when Fe was given in the form of egg.

A discussion of the protein value of egg is given. As the sole source of protein, its biological value is given as 93. Wheat which is short of lysine becomes fully efficient when supplemented by egg, milk, or meat. Egg-yolk is readily digested, but various experiments show the difficulty in digesting raw egg-white. A coagulation of the albumins by heat greatly increases the ease of digestion of egg-white. From a mineral point of view egg is chiefly significant for its iron in the yolk. No other animal tissue approaches egg-yolk as a source of vitamin A except liver, which is more than twice as rich weight for weight in A-content as egg. The A-content of the egg can be increased by adding the vitamin to the diet of the hen. Hens having access to a blue grass range gave eggs with five times the A potency of eggs from hens on the same basal diet having no access to green food. Cod-liver oil also increases the A content of the egg. Storage of eggs causes no appreciable loss in A content. Eggs provide about 15–20 units of B_2 (present almost entirely in the yolk), and are equal to wheat-germ as a source of B_2. Egg-yolk is next to fish-oils as a source of D. No other natural foods furnish more than very small amounts. Both the B_2 and the D content of eggs can be increased by suitable feeding of the hens. Eggs contain some of the pellagra-preventing factor—nicotinic acid—and also B_6.

Some infants are sensitive to egg-white, developing allergic reactions to it. Because of this, and because the white is almost devoid of Ca, P, and Fe, yolk is often best used alone in infant feeding. The combination of egg

(rich in Fe) and milk (poor in Fe) is valuable. Dietary surveys in America showed that about 5·5 per cent of the total food expenditure was for eggs, about 32·2 per cent for meat and fish. Nutritionally, it would be more economical to spend more on eggs and less on meat, as the calories and protein returns are about the same but the eggs for a given expenditure provide much more Ca, P, Fe, and vitamins A and B_1, than the meat.

DOUGLAS C. HARRISON.

Reprinted from "Bulletin of Hygiene," Vol. 14, *No.* 3.

BALSAMELLI, F. Ricerche sul valore vitaminico dei formaggi pastorizzati comparativamente al valore vitaminico dei formaggi freschi e di quelli stagionati. [**The Vitamin Content of Pasteurized, Fresh and Hard (Seasoned) Cheese Compared.**] *Ztschr. f. Vitaminf.* Berne. 1938/39, v. 8, 136–44, 4 charts. English summary.

The result of the tests carried out are given in graphs in the article and the conclusions arrived at were :—

(1) That vitamins A and D are present in similar amounts in all three types of cheese examined and no difference could be detected in this respect between the pasteurized and non-pasteurized ; in other words, pasteurization did not diminish the content of these vitamins.

(2) Vitamin B_1 was present in small quantity in all, a little less in the pasteurized but the difference was so small as to be negligible.

(3) Vitamin C is absent from hard seasoned cheese, and the amount in fresh cheese is small, practically negligible.

(4) Finally, judging from the author's investigations, pasteurization does not reduce to any appreciable degree the vitamin value of cheese.

H. H. S.

Reprinted from "Bulletin of Hygiene," Vol. 14, *No.* 3.

Reviews.

CABOT'S PHYSICAL DIAGNOSIS. Twelfth Edition. By Richard C. Cabot, M.D., and F. D. Adams, M.D. 390 illustrations. Pp. xii + 846. London : Baillière, Tindall and Cox. Price 22s. 6d.

The twelfth edition of this well-known book is published for the first time under the name of the original author in collaboration with Dr. F. D. Adams. The volume has become considerably enlarged by over 200 pages and by some 70 illustrations, and in the subject matter there have been many deletions and substitutions which have, in the reviewer's opinion, greatly enhanced the value of an already important work. These changes have become necessary because, as the authors explain in the preface, the basis of the subject has been altered from an expression of the opinion of a single writer to a representation of the opinions held by many specialists in their own particular spheres. Also, in accordance with the modern trend in

teaching, symptomatology is described more fully in this edition than in the previous one, so as to assist the student in associating the physical signs with other aspects of disease, and to obviate any tendency to regard physical diagnosis and symptomatology as two separate entities. The method adopted in this work gives a much more complete picture of the many conditions discussed. To anyone who does not possess the art of obtaining the essential facts in a patient's history of his illness, much help and guidance will be derived from the new chapter on history taking. Although the book is not intended to be a compendium, there is nothing of importance omitted from the field of physical examination, while the illustrations which are beautifully produced, together with descriptive matter set forth in an interesting and readable manner, serve to commend the work to medical students, clinical teachers, and practitioners alike. R. P.

WHITLA'S DICTIONARY OF TREATMENT. Eighth Edition. By R. S. Allison, M.D., M.R.C.P., Physician with charge of out-patients, Royal Victoria Hospital, Belfast, and C. A. Calvert, M.B., F.R.C.S., Assistant Surgeon to the Hospital. 1938. Pp. vii + 1285. London: Baillière, Tindall and Cox. Price 30s.

The eighth edition of this well-known reference book on treatment has been rewritten with the aid of physicians and surgeons of Belfast, and brought entirely up to date. It includes a very complete summary of well-established methods of treatment in all diseases, including those peculiar to the tropics.

It is very clearly written and easy to read. For anyone requiring a book of reference on treatment none better than Whitla's Dictionary can be found.

H. R.

KER'S MANUAL OF FEVERS. Fourth Edition. Revised by Frank L. Ker, B.A.Cantab., M.B., Ch.B.Edin. 1939. Pp. xvi + 354. Oxford University Press, London: Humphrey Milford. Price 12s. 6d.

A perusal of the fourth edition of this valuable book first published in 1911, reveals that the standard of the previous editions has been more than maintained.

The manual is particularly suitable for the use of students who attend courses of instruction in infectious fevers: but as the subject is dealt with essentially from the clinical point of view the book achieves an additional object in that it is an exceedingly practical and useful work of reference for the practising physician.

The subject matter is well set out and clearly put, and though the text remains to a great extent unaltered as compared with the previous edition, the numerous advances of recent years in the bacteriology and treatment of the infectious diseases are fully and adequately dealt with.

The book can be most confidently recommended as likely to prove a valuable adjunct to the library of the medical practitioner made or in the making. A. E. R.

PHARMACOLOGY AND THERAPEUTICS OF THE MATERIA MEDICA. Fifteenth Edition. Revised by Walter J. Dilling, M.B., Ch.B. 1939. Crown 8vo. Pp. x + 600. London: Cassell and Co., Ltd. Price 10s. 6d.

This book, written for students of medicine and medical men in general practice, has been revised thoroughly and brought up to date.

Many new remedies that have proved their value are described in this edition.

The vitamins are dealt with, including the recent work on B_2 and nicotinic acid in pellagra. Hormones are fully considered, amongst which are the ovarian hormones with their use in menstrual disorders. The new retard preparations of insulin are described.

Part III deals with pharmacology and therapeutics. Here the action of drugs on different systems of the body is set out.

This book is in every way suitable as a manual for reference.

B.

Notices.

THE "AGLA" ATOMISER.

THE "Agla" Atomiser, introduced by Burroughs Wellcome and Co., Snow Hill Buildings, London, E.C.1, produces an effective vapour-like spray from aqueous or thin oily liquids which come into contact with glass only. The atomiser is so constructed that the larger globules of atomised liquid are effectively retained, so that only the finer spray is emitted. Having a flat base and being fitted with a rubber stopper, the atomiser may conveniently be used as a container for the medicament. When filling the atomiser, the level of the liquid should not be more than half way up the delivery tube. A dropper is provided for transferring medicaments to the atomiser. The "Agla" atomiser is of particular value for medication by the oral inhalation method, in which case the patient directs the spray into the open mouth, synchronizing deep inhalations with sharp compressions of the bulb.

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No. 2. August, 1939. Vol. LXXIII.

Journal of the Royal Army Medical Corps

ISSUED MONTHLY

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Price Two Shillings and Sixpence net

VOL. LXXIII. AUGUST, 1939. No. 2

Journal
of the
Royal Army Medical Corps.

Original Communications.

AIR RAID CASUALTIES.[1]

BY COLONEL J. M. WEDDELL, K.H.S.

IN discussing the *types of injury that may be expected* in air raids, it is necessary first to consider the missiles by which such injuries may be inflicted and then the effects of those missiles on the tissues of the body.

MISSILES.

(1) High explosive bombs of heavy weight, intended primarily for the destruction of buildings, including the incendiary bombs. Both of these may of course fall in streets and open spaces as well as on buildings.

(2) Smaller type of bomb (10 to 50 kilos) intended for the destruction of people in the streets and open spaces, including the so-called liquid air bomb.

(3) Machine-gun fire directed against people in streets, traffic, etc. This necessitates low flying machines and with good protection in the air should not be common.

(4) Gas.

The results from these will be :—

(i) Direct hits by missiles and fragments.
(ii) Injuries from explosion (blast).
(iii) Injuries from falling masonry, buildings, etc.
(iv) *Burns* (incendiary bombs).
(v) Effects of gas.

[1] These notes are taken from a lecture given at the Air Raid Precautions Staff School a short time ago, and it is hoped they may prove of interest.

Types of Wounds to be Expected.

(1) *Penetrating Wounds.*—Entrance wound and track without exit wound. These are typical of the small shell or bomb fragments.

The characteristics are that they are frequently multiple. The fragments have a relatively low power of penetration and often lodge in the body. They frequently carry clothing and gross dirt into the tissues. The effect of the explosive is as destructive as the fragmentation. All such wounds must be regarded as grossly infected.

The casing of these missiles is apt to be broken up into small scale-like particles the size of a thumb-nail and cause very small entrance wounds which may easily be overlooked, and yet from the intense rotary movement of the fragments may cause very severe internal damage.

(2) *Perforations.*—This is the typical wound inflicted by the small-bore high-velocity rifle or machine-gun bullet.

It consists of an entrance wound, a track, and an exit wound.

The entrance wound is usually a small punched-out hole.

The track always shows a high degree of disorganization of tissue, is larger than the calibre of the bullet and is lined with devitalized tissue mixed with blood-clot.

Solid organs are pulped and often show radiating fissures.

Hollow organs are frequently torn and the degree of damage is often out of proportion to the size of the missile.

The modern pointed bullet is definitely more unstable, and its effects on the tissues are much more severe than the blunt-nosed Mauser bullet in general use in the South African War. That is to say there are relatively fewer clean perforating wounds with the modern bullet. Bone is usually broken into small fragments, some of which may be forced into the surrounding tissues or even through the skin.

The *exit* wound may be the same punched-out hole as the entrance wound. More often it is a good deal larger and lacerated. At short ranges explosive exit wounds are almost invariable.

(3) *Severe Lacerated Wounds.*—Usually due to large shell fragments, are of the same nature as some machinery accidents in civil life. The extremities may be carried away, avulsion at the shoulder or hip having occurred. The thoracic cavity may be torn open and lung herniated. The abdominal cavity may be ripped open with extravasation of the intestines. Naturally such wounds are practically always fatal.

In addition in air raid casualties one may expect many crush injuries and fractures. Injuries from glass and also burns.

Experiences in Barcelona.

(Report from Spanish Surgeon.)

" (*a*) Bombs falling in the streets and open spaces. The heavy high-explosive bomb produced a huge crater sometimes as much as 4 metres deep. When one of these fell on the hard paving of city streets, the majority of

those in the immediate vicinity were killed outright. Owing to the depth of the crater and the high angle of the blast the radius of destruction was fairly limited—fragments of stone produced comminuted fractures and perforations of the intestine similar to those caused by sharp splinters of metal. People lying flat on the ground in wide streets below the range of the blast often escaped unwounded though shaken and terrified.

(*b*) Small bombs (under 50 kilos), with little penetrative power but great lateral explosive effect.

Fragmentation occurred at a very low level. Caused many casualties to those in streets. These did not pass through more than one storey, so that buildings did give a certain amount of protection.

(*c*) Casualties from bombs falling on buildings.

The high-explosive heavy bombs caused tremendous destruction.

(*d*) Shrapnel wounds were rare since the collapse of the buildings was caused by the enormous expansion of the gases and the partition walls protected the occupants from splinters. The modern shrapnel is composed mainly of rectangular pieces of metal and metallic discs about the size of a penny, not the spherical metallic balls frequently used in the last war. There were large numbers of wounds of the abdomen, extremities, and head caused by stone, glass, etc., and also a large number of injuries due to crushing. The mortality rate was very high owing to the actual nature of the lesions and also to the difficulty of attending to the wounded buried under the debris. Shock was very marked.

Clinical Study of the Wounds.

Multiple wounds were very common. It was found necessary to examine the wounded stripped, as owing to the state of shock and smallness of some of the penetrating wounds, these were easily overlooked. In serious cases of crush injuries it was often quite impossible to operate owing to the state of shock and severity of the lesions, e.g. severe internal hæmorrhage through rupture of the liver or intestines, multiple fractures, etc.

One symptom common to all air raid casualties, especially those injured inside buildings, was a markedly low blood-pressure, with a waxy colour and a state of mental alertness, sometimes excited, rarely depressed except in the very serious cases not likely to recover (i.e. typical, severe shock). In operating, spinal anæsthesia was contra-indicated owing to the low blood-pressure.

Regional or local anæsthesia by infiltration was often contra-indicated when there was much bruising of the surrounding tissues, and also because of the time occupied in this method. Best form of anæsthesia was gas and oxygen or ether.

Injuries from shell fragments and splinters from *anti-aircraft fire* might occur. Inert masses of metal were falling from roughly 25,000 feet, and the casing was shattered into minute particles.

The resulting injuries occurred almost exclusively in the head and clavicular regions ; these often caused immediate death.

Adequate numbers of rescue gangs were found to be essential, and the saving of life was largely dependent on the efficiency of these parties in rescuing those pinned down by debris and fallen buildings.

(In Barcelona first-aid parties did not waste time in splinting fractures, but rushed cases to the nearest fixed establishment for treatment.)"

Shock.

Shock may be Primary or Secondary.

Primary shock occurs on the receipt of a wound, injury, or mental disturbance, and is a reflex response to violent sensory stimuli. It is probably due to vagal inhibition of the heart and is of the nature of a syncopal attack ; unless it is so severe as to cause death almost immediately recovery tends to take place spontaneously and usually rapidly, but, if the patient is exposed to cold, or is suffering great pain, or has been previously exhausted and starved, or if progressive hæmorrhage is going on, the pulse-rate begins to rise, the body temperature and blood-pressure fall, and he passes into the condition of secondary shock.

Secondary shock may develop some hours after receipt of a wound or injury ; the patient is pale, collapsed, and apathetic, non-responsive to stimuli ; he is sweating freely, the body surface and breath are cold, the pulse and respirations are rapid and small, the blood-pressure is low ; thirst is common. Death may take place early with dyspnœa and cardiac failure ; consciousness is retained until the end.

The essential clinical feature of shock is a prolonged and progressive fall in the blood-pressure which may arise from a variety of causes.

With the establishment of a low blood-pressure a vicious circle is set up ; the prolonged hypotension leads to suboxygenation of the tissues and capillary stasis. This capillary stasis (or probably leak) reduces the amount of circulating fluid and the suboxygenation of the tissues results in the appearance of various toxic products from imperfect tissue metabolism. These collectively further reduce the blood-pressure and the vicious circle goes on. It will continue to a fatal issue unless some link in the chain is broken and the error in the blood-pressure is overcome.

To sum up the general points about shock it may be said that :—

The initiating factors are : (1) Pain. (2) Hæmorrhage. (3) Cold. (4) Absorption of toxic products from injured tissues.

The sustaining features are : (1) The low blood-pressure. (2) The decreasing blood volume.

The *results* are : (1) Diminished circulating fluid. (2) Deficient intracellular oxygenation. (3) Devitalization of organs—heart, brain, kidneys, etc.

With regard to the initiating factors, it will be seen that although shock cannot always be completely prevented, we can do a great deal towards guarding against or treating the initiating factors.

(1) *Pain.*—Can be relieved by efficient dressing and immobilization of the wounded part. The adequate immobilization and extension of fractures has an enormous influence on the comfort of the patient and on the prevention of shock in patients who have to be transported any distance.

Gentle handling of the patients is essential, also as comfortable a position as possible, e.g. flexion of thighs in abdominal wounds.

The use of sedatives: The injection of morphine (grain $\frac{1}{4}$–$\frac{1}{2}$) is an excellent sedative. Whenever morphia is given a record of the dose and time it was given must accompany the patient for the information of others who will treat the patient later.

(2) *Bleeding.*—In gunshot wounds the patients are frequently suffering from hæmorrhage and shock combined. Therefore the control of bleeding and the restoration of fluid to the tissues are of vital importance. For those who can take fluid by the mouth, hot sweet tea is an excellent method of restoring fluid and warming the patient; other means are infusions and transfusions of blood.

(3) *Cold.*—It is essential to keep the patients warm, but not overheated, as this will cause excessive loss of fluid by sweating. A patient on a stretcher must be protected by placing the waterproof sheet and blankets underneath as well as over him. Artificial heat can be supplied by hot-water bottles, electric cradles, etc. Motor ambulances must be warmed.

(4) *Infection.*—Careful dressing of the wound and rapid evacuation of the patient for operative treatment.

HÆMORRHAGE.

This may be external or internal.

Internal Hæmorrhage.—The signs of severe internal hæmorrhage are: Increasing pallor—blanching of skin and mucous membranes. Cold clammy skin. Increasing rapidity and weakness of the pulse. Thirst. Restlessness —air hunger.

(The patient suffering from pure shock lies very still.)

The treatment of internal hæmorrhage is operative. Warmth, sedatives such as morphine, and rapid evacuation to the operating centre constitute the first-aid treatment.

> N.B.—The early cause of death in abdominal wounds is intraperitoneal hæmorrhage, and it is essential to get these patients to the operating centre as rapidly as possible, and with them more risk from rapid evacuation may be run.

External Hæmorrhage.—The methods of treatment are: (1) A firm evenly applied bandage over a sterile dressing. (2) Packing of deep oozing wounds. (This is not a method of choice but oozing wounds are a great source of shock during transport and this method may have to be employed.) (3) Forcipressure. (4) Direct ligation of bleeding vessels (both ends). (5) Application of a tourniquet.

With regard to tourniquets, frequently they are very much less necessary than is apt to be imagined. They can be extremely dangerous. They should only be employed with sufficient force to stop the hæmorrhage.

The dangers are: (1) Severe local infection almost invariably follows the prolonged use of a tourniquet. Massive gangrene of limbs has occurred on many occasions. Also damage to nerves may be very serious. It is a wise plan to loosen the tourniquet every fifteen or twenty minutes to see if bleeding has been checked. (2) A tightly applied tourniquet causes a great deal of tissue damage and on release acute symptoms of shock may develop. (3) They are very painful.

The ill-effects of a tourniquet are liable to be very much more severe in the case of the arm than in the more muscular thigh.

In any case where a tourniquet has been applied it is essential to label the patient conspicuously or mark the forehead with a T, stating the time of application of the tourniquet.

Types of Tourniquet.—Pad over pressure points. All first-aid workers should know the lines of the main arteries for application of such tourniquets. Samways rubber applied as low as possible in avulsed or badly shattered limbs.

The decision as to the initial disposal of cases is an extremely important matter.

(1) There will be a certain number of walking cases who can return to their homes after dressing of the wounds, returning at a later date for further treatment. A number of walking patients will require to rest for a time before returning home, and it is necessary to arrange a room or space for this purpose.

(2) There will be walking wounded who require hospital treatment and possibly operation. Such cases are wounds of the jaws and of the upper extremity.

(3) Stretcher Cases.—The most urgent of these for operative treatment are the penetrating abdominal wounds; as stated before, the cause of death in the early stages of these is hæmorrhage. Cases requiring urgent surgical treatment are the penetrating wounds of the skull; the severe chest wounds with an open or valvular pneumothorax; severe compound fractures; cases of severe hæmorrhage and of extensive burns.

CARBON MONOXIDE POISONING:

A Review.

By Brevet Lieutenant-Colonel A. E. RICHMOND, O.B.E.,
Royal Army Medical Corps.

Carbon monoxide, together with the dioxide, occurs in the combustion of organic matter, and the less oxygen there is available the greater the proportion of carbon monoxide produced. It is colourless and odourless, and on these accounts its presence is normally only detectable by the symptoms it causes, which adds much to the risk of poisoning from it. It it also inflammable and in strong concentration may give rise to explosions.

It has been recognized as a poison since ancient times, and has assumed special importance within the last half-century owing to the increased amounts of it produced consequent upon the augmented use of gas for illuminating, cooking, and heating purposes, and upon the introduction of the internal combustion engine.

It is the favourite means of the suicide to encompass his aim, while accidental poisoning with it frequently occurs. From a military point of view carbon monoxide intoxication is a subject which deserves the close attention and study of all military medical officers in these days of intensive mechanization, and unlimited employment of explosives; and the object of the writer is to lay before his readers in as concise and compact a form as possible those details of moment in connexion with the various aspects of this important subject.

In endeavouring to attain this object references have been made to certain publications dealing with carbon monoxide poisoning. These references are clearly indicated, so that those desirous of making a more detailed study of the matter may have available the same assistance as has been at the disposal of the author and which he most gratefully acknowledges.

Carbon monoxide enters the body through the lungs and by no other means. Drinker [1], in his recently published and most valuable book on the subject, quotes observations by Sendroy Liu and Van Slyke which appear to have established the affinity of carbon monoxide for hæmoglobin compared with that of oxygen as being in the proportion of 210 : 1. This is a significant fact, and the ease with which the carbon monoxide is taken up by hæmoglobin is the essential feature of the toxic syndrome.

The oxygen-carrying capacity of the blood is in this way interfered with to a greater or less degree, and in severe cases of poisoning disastrous and enduring states of anoxæmia may arise with all their resultant adverse effects.

It will be realized also that this amazing affinity of carbon monoxide for hæmoglobin is an obvious explanation of the occurrence of cases of poisoning in individuals exposed to comparatively low concentrations of the gas.

The combination of carbon monoxide with hæmoglobin is very slowly reversible, and oxygen will displace it when the individual is removed from the poisonous atmosphere. This is due to the mass action of the oxygen in the air, and the process may be accelerated by the administration of pure oxygen in the usual way.

Carbon dioxide exerts a benevolent influence, as this gas affects the combination of both oxygen and carbon monoxide with hæmoglobin, which is less able to hold these gases as the carbon dioxide increases. Hence the importance of the administration of carbon dioxide in treatment as it acts not only by aiding the dissociation of carbon monoxide from hæmoglobin, but also by stimulating the respiratory centre.

When non-fatal concentrations of carbon monoxide are present in the air breathed, the partial pressure in the blood gradually reaches a state of equilibrium with that in the air, and so the blood concentration is prevented from reaching a lethal height. As an example of this, with an atmospheric percentage of 0·05 the maximum hæmoglobin saturation with carbon monoxide produced will be 40 per cent, which will be attained in practically four hours.

Perhaps of special importance from a military point of view is the effect of the low barometric pressures, which may be found at great heights, on the absorption of carbon monoxide by the blood. Such influence is clearly adverse owing to the reduction in partial pressure of the oxygen due to the carbon monoxide taken up coupled with that consequent upon the low barometric reading. This will serve to emphasize the danger of subjecting persons to carbon monoxide at high altitudes.

It should be noted that mice and small birds die more quickly from carbon monoxide poisoning than men, owing to the fact that their volume of breathing per minute compared with the total volume of their blood is greater than in the case of man, and it is stated that the average man ought to be able to remain in an atmosphere with a given concentration of carbon monoxide twenty times as long as a canary.

It appears to have been definitely established that carbon monoxide inhaled in small amounts over periods of time has the power to increase the red cells and the amount of hæmoglobin in the individual [2].

The augmentation of the erythrocytes is thought to be due in the early stages to contraction of the spleen, but it would seem that later true new red cell formation definitely occurs in the bone-marrow.

Finally, the fact must not be lost sight of that on cessation of respiration the excretion of carbon monoxide also ceases, and that evidence of it in the blood may be found for months or even years afterwards.

Dangerous Percentages of Carbon Monoxide.

In considering this aspect of the subject with which we are dealing, realization of the fact that given concentrations of carbon monoxide in the atmosphere will not affect every individual equally is essential. Not only

do individuals vary in their reactions to this gas, but other modifying influences in the situation are also frequently present.

It is also important to realize that dangerous precentages of carbon monoxide will never be reached in open spaces owing to the rapid diffusion of the gas, and that risks from it only arise in enclosed spaces, or in semi-enclosed in which ventilation is inadequate or stagnation of air exists.

Individual susceptibility depends to some extent upon age, and Drinker emphasizes that the very young and very old are at greater risk than others. "The Medical History of the War" [3] states that young men were more susceptible to carbon monoxide than those over 40, due apparently to their greater elasticity of chest wall and deeper inspiration.

Although there may be some doubt as to the influence exerted by sex, there appears to be no question that pregnant women are more liable to fall victims to poisoning by carbon monoxide than others.

Such abnormal bodily conditions as anæmia, heart disease, asthma, chronic bronchitis, alcoholism and narcotism have a material and detrimental effect in carbon monoxide intoxication, while of prime importance is the extent of any bodily activity taken in the poisoned atmosphere. In this connexion Drinker quotes certain experiments by Sayers, Meriwether and Yant, [4] which illustrate the effect of rest and strenuous exercise respectively on carbon monoxide absorption. These investigations showed that persons at rest breathing 0·02 per cent of the gas developed 16 to 20 per cent hæmoglobin saturation with mild subjective symptoms at the end of six hours. On the other hand, an individual exercising strenuously in 0·025 per cent of carbon monoxide had 14 to 16 per cent saturation in one hour with moderate subjective symptoms.

These experiments serve to emphasize the consideration we must give to the degree of activity of the soldier or anybody else in an atmosphere containing carbon monoxide, if we are to assess correctly the extent of the risk.

As regards atmospheric conditions, low barometric pressure is a factor of considerable moment, and the intake of carbon monoxide at the low pressures of great altitudes will have infinitely more rapid and serious results than would be the case at normal heights. Hence the great necessity for efficient safeguards against the inhalation of exhaust gases of aeroplanes while in flight. High temperatures and humidities also accelerate the rate of combination of the gas with hæmoglobin.

Varying susceptibilities of animals and birds as compared with man must also be given passing thought as they are of importance in the selection of test creatures for experimental and other work. In this connexion Drinker quotes Anson, Barcroft, Mirsky and Oinuma [5] as showing that carbon monoxide has an effect on animals, etc., in the following descending order of potency : Dog, horse, cat, man, fowl, mouse, rat, tortoise, sheep, lizard, frog, and rabbit. Similarly, in the case of smaller animals and birds Burrell, Seibert and Robertson [6] concluded that the following was the order of

degree of susceptibility : Canary, mouse, chicken, small dog, pigeon, sparrow, guinea-pig, and rabbit.

Finally, we must not lose sight of the fact that carbon monoxide varies in its effects according as to whether it is alone or in combination with other gases. For instance, illuminating gas is of higher toxicity than pure carbon monoxide, as also is the exhaust gas from a car using coal distillate.

There appears to be little to choose between pure carbon monoxide in air and the ordinary petrol exhaust gas.

From a practical point of view we have to deal in averages when we consider the important question of the maximum permissible concentrations of carbon monoxide in an atmosphere and of the effects likely to be produced by concentrations in excess of such a limit.

Many investigations have been carried out in these connexions by experts on the subject, such as Haldane (1897), Henderson (1921–22), Sayers, Meriwether and Yant (1922), Sayers, Yant, Levy and Fulton (1929) [7], and others, but space does not permit of a detailed consideration of the valuable contributions of these workers to the store of information now available. On the other hand, it is possible to summarize in a concise form the conclusions come to, and from the viewpoint of the practical hygienist, military or otherwise, such a summary is the essential need.

First and foremost it was clearly established that a carbon monoxide concentration in the blood equivalent to at least 20 per cent of saturation is necessary before the average adult complains of toxic symptoms, provided he is at rest. Minor symptoms, though, may occur with exercise with blood concentrations of 10 to 20 per cent.

Secondly, symptoms may be expected to develop at rates varying with the concentration of the gas in the atmosphere breathed and subsequently in the blood according to the tables given below.

It must, however, be borne in mind that, as already stated, individuals vary in their reactions to carbon monoxide and consequently the table must be accepted as only giving an indication of the average state of affairs likely to be produced by varying concentrations of the gas for different periods of time.

Concentration in air	Maximum % saturation of hæmoglobin that will be attained	Period of exposure in hours required to reach certain percentage saturations								
		10%	20%	30%	40%	50%	60%	70%	80	90
%	%									
0·01	14·3	2	–	–	–	–	–	–	–	–
0·05	45·5	½	1¼	2	4	–	–	–	–	–
0·1	62·5	1/3	¾	1¼	2	3	5	–	–	–
0·2	77·0	1/6	1/3	½	2/3	1	1½	2¼	–	–
0·5	89·3	1/8	1/5	1/3	3/8	½	5/8	¾	1¼	–
1·0	94·3	1/12	1/8	1/5	¼	1/3	3/8	½	¾	–
5·0	98·8	1/100	1/60	1/16	1/12	1/9	1/7	1/6	3/8	¾

SYMPTOMS LIKELY TO OCCUR AT VARYING PERCENTAGE SATURATIONS OF THE BLOOD.

(*Taken with slight modifications from Review of Carbon Monoxide Poisoning, United States Public Health Service*, 1930.)

%	
0—10	None.
10—20	Possibly slight headache with dilatation of the cutaneous vessels and tightness across the forehead. Shortness of breath on exertion.
20—30	Headache. Throbbing in temples. Muscular weakness.
30—40	Severe headache, weakness, dizziness, confusion of mind, lack of concentration, dimness of vision, nausea, vomiting, collapse.
40—50	As above but greater possibility of collapse and syncope ; increased respiration.
50—60	Syncope. Increased respiration. Coma with intermittent convulsions. Cheyne-Stokes respiration.
60—70	Coma with intermittent convulsions, depressed heart action and respiration. Possibly death.
70—80	Weak pulse and slowed respiration. Respiratory failure and death.

Thirdly, certain general findings emerged from the work done which may be tabulated as follows [8] :—

(1) The combination of carbon monoxide with hæmoglobin takes place slowly when the subject is exposed to low concentrations and remains at rest, many hours being required before equilibrium is reached.

(2) The rate of combination of carbon monoxide with hæmoglobin is much more rapid during the first hour of exposure than during any succeeding hour with the subject remaining at rest.

(3) Strenuous exercise causes more rapid combination of carbon monoxide with hæmoglobin than when the subject remains at rest, the symptoms of poisoning therefore being emphasized by exercise. This accelerated combination is due partly to the raised body temperature and partly to increased respiration.

(4) High temperature and humidity with a given concentration of carbon monoxide cause more rapid combination of the gas with hæmoglobin than under normal conditions.

Finally, as regards the question of the maximum permissible limit of carbon monoxide in an atmosphere, Drinker's dictum to the effect that in houses, garages, or manufacturing establishments where there is prolonged exposure to carbon monoxide, concentrations above 0·01 per cent should not be permitted, may be accepted as adequate to the need. On the other hand, in special circumstances and where the period of exposure is strictly limited, a higher limit might be permitted. This was done in the case of the Holland vehicular tunnel in New York where a limit of 0·04 per cent of carbon monoxide was imposed [9]. With this concentration, a driver of a car after one hour would have less than a 20 per cent saturation rate and, apart from this, the margin of safety was a large one inasmuch as the trip through the tunnel would normally be only ten to twelve minutes in duration, although exceptionally the period of time occupied might be forty minutes.

Sources of Carbon Monoxide and its Concentration in the Atmosphere in Certain Conditions.

The more common sources of this gas will be well known to many readers.

The ordinary coal gas is a mixture of gases of which carbon monoxide forms a large proportion. Illuminating gas is usually a combination of coal and water gas, and the average carbon monoxide content is some 15 per cent. Water gas contains as much as 30 per cent.

It would appear at present unnecessary to discuss this aspect of the matter further as it is clear that carbon monoxide in the atmosphere due to illuminating gas will vary enormously as regards the proportion present, and that this may be very small indeed in the case of small leaks, or very high when the gas is used for purposes of suicide.

It will be necessary, however, to go into the question in rather greater detail in connexion with preventive measures.

Carbon monoxide is produced whenever incomplete combustion of carbon-containing fuel takes place in the absence of sufficient oxygen.

Coal, oil, charcoal, coke, wood, etc., may therefore all give rise to this intoxicant, and the circumstances under which it may be produced from such fuels are multifarious, though the basic cause is usually insufficient ventilation. Blocked flues, for instance, may be the cause of trouble, and it will be remembered that Emile Zola died in 1902 as the result of carbon monoxide poisoning due to a faulty stove.

Coke braziers burnt in ill-ventilated rooms are too well known a reason for carbon monoxide poisoning to necessitate further comment, and it will not be difficult for the reader to realize that similar lack of ventilation may occur under certain circumstances in all sorts of stoves, furnaces, and the like.

The occurrence of large quantities of carbon monoxide in burning buildings is too familiar also to need much emphasis. The more confined and smothered the fire the more dangerous it is, and it is of the greatest importance that firemen overcome by fumes should be treated as cases of poisoning.

It will be well to interpose at this point some information as to the approximate percentages of carbon monoxide found in certain more common circumstances, and this is given in the table on page 85. The figures given have been obtained from various sources [10], and they should be regarded as average readings only, and that considerable variations from them are quite likely to be found.

There are certain sources of carbon monoxide which on Service, and to some extent during the piping times of peace, are likely to be productive of anxiety among us as Army medical officers, and it seems essential that a particularly intimate and detailed consideration should be devoted to them.

To deal first with the risks to those driving or conveyed in mechanical vehicles of varying description, it has already been stated that the ordinary petrol exhausts contain some 4 to 7 per cent of carbon monoxide.

Such gases, if adequate measures of disposal are not employed, may gain entry into closed or partially closed vehicles by various means. Defective

exhaust disposal may include leaking exhaust pipes or the placing of these in such positions that the gases are not delivered clear of the vehicle, leaky gaskets in exhaust connexions, leaks in mufflers, and leaky piston rings permitting exhaust gases to enter the crank case and be discharged into the vehicle.

TABLE.

Percentage of carbon monoxide found in common circumstances.	Per cent
Illuminating gas	15
Exhaust gases of motor-cars	4—7
Diesel engine exhaust	0·1—0·3
Railway engine smoke	2
Blast furnace gases	28
Bessemer furnace gas	25
Coke oven gas	6
Explosion gases—	
Dynamite	34
Nitroglycerol	46
Picric acid	61
Mine air—	
Coal pits	0·104 (maximum)
Immediately after dust explosion (experimental)	8
One day after a coal mine explosion	1
Mine fire	1
Seven minutes after blasting with gelatine dynamite	1·2
Air in garages	0·05
Air in railway tunnels	0·01
Air in traffic roads and tunnels	0·04 (maximum)

The necessity, therefore, for thorough and regular inspections of mechanical vehicles with a view to the elimination of any possible defects of the nature mentioned will be appreciated, as also for the application of similar precautions in the case of motor boats, launches, and the like.

Occupants of such vehicles may also be at risk from carbon monoxide poisoning in other ways. There appears, for instance, to be no doubt that a lorry with no through ventilation from front to rear—a state of affairs which may occur when the " window " in the front of the lorry behind the driver's seat is not kept open—may create a partial vacuum in the neighbourhood of the rear portion of the vehicle into which exhaust gases may diffuse and so gain entry into the lorry. Similarly, with a slow-moving vehicle, a following wind may at times blow these gases into it. It is also stated by some that poisonous concentrations of carbon monoxide may be found in a vehicle following close behind another in traffic. Similarly aspiration of exhaust gas from below into a closed vehicle may occur owing to the passage of air currents through the upper portions of the vehicle, whether in the ordinary way or possibly due to exhaust ventilators in the roof.

In this connexion Henderson and Haggard [11] have stated that a stationary car with the motor running fills the air behind it at respiratory level with 0·04 to 0·06 per cent of carbon monoxide, and that when running at 10 miles per hour, the occupants of a car 30 feet behind are surrounded by exhaust gases to a concentration of 0·01 to 0·02 per cent. Lehmann gives

somewhat similar figures as regards the carbon monoxide content of air at the back of a motor vehicle—0·04 to 0·05 per cent.

Drinker considers that as far as the occupants of following cars are concerned exposure would be very transient and unlikely to cause harm, and points out that no accidents are reported from an experience of this description.

The possibilities of untoward occurrences of this sort, however, cannot be altogether dismissed, and they should be regarded as a definite risk in connexion with mechanized formations under certain circumstances.

It might well be expected that in narrow city streets full of a conglomeration of motor vehicles or in narrow defiles or cuttings crowded with many vehicles moving very slowly, or perhaps for some reason stationary with engines running, toxic proportions of carbon monoxide might be produced sufficient to cause symptoms in point duty police or even in pedestrians and others.

In this connexion investigations carried out by Henderson and Haggard in 1923 showed that 0·01 per cent of carbon monoxide was quite commonly present in certain streets in New York City, and that 0·046 per cent was occasionally present for brief periods of time. Wilson, Gates, Owen and Dawson [12] in 1926 examined the blood of fourteen traffic policemen in Philadelphia after an eight-hour tour of duty in crowded parts of the city and found carbon monoxide blood saturation of from 0 to 30 per cent, six of the men showing values of about 20 to 30 per cent, quite sufficient to cause minor symptoms of poisoning. Other later observers, however, quoted by Drinker—Connolly, Martinek and Aeberly, 1928, and Bloomfield and Isbell, 1928—after extensive investigations found to all intents and purposes negligible concentrations in the streets of Chicago and other cities.

Bloomfield and Isbell [13] concluded that the figures for street air when viewed in the light of present-day standards of exposure to carbon monoxide did not reveal the existence of a health hazard from this source and that the only individual who might possibly be exposed to risk from inhaling street air containing exhaust gases is the traffic officer.

They also pointed out that any potential hazard there might be could be minimized by diminishing the duration of exposure at the most congested traffic stations.

Hepple's work [14], too, in 1929 suggests that the risk of carbon monoxide poisoning in crowded streets is largely negligible, and in samples of air taken in traffic blocks of about two minutes' duration in London streets, the large majority showed percentages of considerably less than 0·01.

Taking the wide view, we may to a material extent dismiss the possibilities of carbon monoxide intoxication of traffic duty men from our minds. We must, nevertheless, realize that, whether in peace or in war, exceptional circumstances may at times arise in narrow and enclosed streets or roads, and with them an exacerbation of risks of the nature referred to with the consequent necessity of taking steps to guard against them.

It appears pertinent at this point to give brief consideration to the question of the occurrence of carbon monoxide in garages, repair shops and the like.

It is in small garages that fatal accidents are peculiarly apt to occur, owing to the fact that while most people realize the dangers of running an engine in a closed space they do not understand how quickly and insidiously acute poisoning may develop. Drinker, in order to emphasize this last point, quotes an experiment by Yant, Jacobs and Berger [15] in 1924, in which they showed that in a garage of 2,950 cubic feet capacity, a dog was unconscious in twelve minutes and dead in twenty-five minutes after the engine of a car had been started running at 200 revolutions per minute, and that at the end of twenty-five minutes the garage air contained 1·31 per cent of carbon monoxide. At the end of an hour the figure had risen to 1·97 per cent, and after two hours the engine stopped due to lowered oxygen in the garage air. At this point carbon monoxide content was 3·10 per cent.

Drinker also points out the obvious fallacy of the belief held by many that there is no danger as long as the engine will operate.

It is clear that in small garages dangerous concentrations of carbon monoxide will develop very rapidly indeed ; so much so that the conditions produced would be sufficient to produce unconsciousness in a man in five minutes and death soon after. It must be remembered, also, that such factors in the situation as operating the engine with the carburettor adjusted for a rich mixture, or the performance of muscular work with the consequent more rapid inspiration and absorption of the gas, will tend to render the state of affairs considerably worse.

Finally, we should not be slow to realize that fatal poisoning is often assisted by the fact that the gas renders the individual helpless and incapable of moving out into the fresh air, although he may realize the necessity for this.

As far as large garages and repair shops are concerned, the situation is one of repeated daily exposures to small quantities of carbon monoxide, and it would appear that many garages and repair shops show concentrations of this gas of more than 0·01 per cent. That is to say that there is enough carbon monoxide to cause headache and malaise, if not in all at any rate in some workers after an eight-hour shift, and, as Drinker states, this will often be the case even in mild weather with a fair number of windows open. This writer in his book gives the result of blood examinations carried out by Mayers [16] in 1930 on twenty-seven garage workers exposed to 0·11 to 0·023 per cent of carbon monoxide from exhaust gases. These showed blood concentrations varying from 0·00 to 30·1 per cent, most of the readings being between 2 and 20 per cent.

Carbon monoxide is produced also by the detonation of explosives, and it is stated that 1 kilogramme of modern high explosive will give rise to 600 to 800 millilitres of carbon monoxide. It is clear, therefore, that this aspect of the matter under discussion is a most important one from the

Service point of view, and readers are reminded that it is dealt with very fully in "The Medical History of the War, Diseases of the War," Volume II.

The gas is slightly lighter than air, and diffusion takes place so rapidly that in open spaces there is no great risk from high explosive shells, as far as poisoning is concerned, to those in the neighbourhood.

When, however, such a shell, particularly if it has a delay-action fuse, penetrates the soil and bursts in the neighbourhood of a deep dug-out or other relatively confined space, the carbon monoxide generated may find its way into the dug-out and poison the occupants.

Large numbers of casualties occurred in this way during the Great War, and the explosion of mines and camouflets similarly was responsible for many cases of poisoning.

Mine warfare was a prominent feature of the campaign in France and Flanders, and as evidence of this may be mentioned the fact that in 1916 alone the enemy fired 696 mines and camouflets and the British 750. As warfare of this nature is likely to be indulged in again to a material extent, it will be well to call to mind some of its salient features from the particular aspect of carbon monoxide intoxication.

During the Great War nearly all the explosives used were of the ammonium nitrate group, chiefly ammonal. Gunpowder was employed to a negligible extent owing to the fact that it produces excessive quantities of carbon monoxide (40 per cent with complete detonation, 54 per cent with incomplete) and that there is grave difficulty in clearing the ground of the gas afterwards.

Explosives of the ammonium nitrate group used contained, generally speaking, an excess of oxygen, and theoretically should give rise to little or no carbon monoxide. They are, however, hygroscopic, and in the presence of moisture comparatively large quantities of the gas may be evolved on detonation. On this account this group of explosives affords less risk of carbon monoxide poisoning when employed in the deeper and dryer mines than when used in the shallower and moister types.

Certain general considerations in connexion with mining and irrespective of the nature of the explosive used are of some practical importance and might well be borne in mind.

In the first place, with any given explosive the amount of carbon monoxide it produces may be much increased if it is of poor quality or if insufficient or weak detonators are employed.

Secondly, the experience of the Great War showed that there was very much less trouble from gas after the enemy had fired a mine (crater-formed) than after a camouflet, when the surface of the ground was not broken: also that when the galleries were driven through clay, mines became quickly cleared of gas and the ground did not become impregnated with carbon monoxide to any such degree as occurred when the galleries were driven through chalk or other pervious strata.

Thirdly, that in ground of a pervious nature it was by no means unusual for collections known as "pockets" of gas to be formed and for these to be

tapped later, when the gas would come through with a whistling sound showing that it was under pressure.

Finally, sudden inrushes of gas into galleries at the time free of gas must occasionally be expected and may be due perhaps to sudden settling of ground or possibly to changes in atmospheric pressure or in the subsoil water level.

"The Medical History of the War" gives special mention to carbon monoxide poisoning in craters, and points out that the continuous fighting for craters was one of the most important features of stationary trench warfare. In view, moreover, of the fact that often only a very few minutes elapsed between the moment when the mine was exploded and the occupation of the crater by the infantry, it might have been expected that many cases of gas poisoning would have occurred in this way. In actual practice such cases were comparatively few owing to the porous condition of the earth in the crater and of the ground in the immediate vicinity, with consequent rapid dispersal of the gas.

It was only when large quantities of gas were produced, as with an incompletely detonated mine, and when atmospheric conditions were favourable (absence of wind or a dull heavy atmosphere), that gas collected and poisoned the men who had rushed the craters.

Carbon monoxide is also generated in the firing of guns, and a good many cases of intoxication with the gas occurred during the War in gun pits and especially in closed machine-gun emplacements [17] owing to the blow-back from the guns, and at one period the disablement of machine-gun crews from this cause became a somewhat serious question until measures were taken to reduce the amount of firing in prescribed periods of time within certain fixed limits.

The risks, of course, were identical in tanks [18] and armoured cars from which machine guns were fired, and adequate mechanical ventilation of such armoured fighting vehicles is essential to deal not only with accumulations of carbon monoxide but also with the excessive heat and humidity which, combined with the gas referred to, are likely to exert an extremely malevolent effect on the crews.

Finally, and of importance from the Service point of view, is the necessity for a word of warning in regard to the possible risks of poisoning from small petrol engines and from the use of braziers, particularly in enclosed or semi-enclosed spaces.

Small power petrol engines were used for power purposes to a material extent along the whole front in France and quite frequently were installed in dug-outs. The danger from this is too obvious to need further emphasis, as also is the urgent need for ensuring that adequate arrangements for disposing of the exhaust gases produced are made.

For warming purposes, braziers also were in common use in the winter in the trenches and elsewhere, and the proper supervision of these, together with the taking of adequate steps to ensure satisfactory ventilation of any enclosed or semi-enclosed spaces in which they are employed, is clearly a

matter of extreme moment if casualties from carbon monoxide poisoning are to be avoided.

Acute Poisoning

The symptoms of acute poisoning with carbon monoxide may most conveniently be considered with reference to three stages, these being as follows: (1) Onset; (2) established poisoning; (3) later developments and sequelæ.

As regards the first of the stages, Haldane's invaluable and courageous work, which included many experiments upon himself, has contributed largely to our knowledge of the symptoms.

Those likely to predominate are headache, giddiness, nausea and perhaps vomiting, while in a large proportion of cases confusion of mind and inability to concentrate will appear early.

The importance of these effects from the point of view of military efficiency will be fully realized, and it is clear that the fighting qualities of troops, after being subjected to toxic amounts of carbon monoxide, even for short periods, may be seriously affected.

Muscular weakness may also be expected to commence development at this stage, and is of special moment as it often means that a man, while knowing he should get away from the contaminated atmosphere, is incapable of doing so.

With the onset of the second stage, drowsiness becomes a marked feature of the case, and it progresses gradually to complete unconsciousness.

At the same time respiration commences to fail, the manner in which this occurs tending to vary with different individuals. Sometimes, as described by Drinker, it is of the gasping type, sometimes a feeble rapid respiration so slight as to be hardly visible, sometimes rapid fluttering respirations interspersed between gasps.

As regards the cardiovascular system, it is interesting to note that the action of the heart and condition of the peripheral circulation are often surprisingly good, and it is on this account that artificial respiration with inhalation of oxygen and carbon dioxide produces in many cases such rapidly beneficial results.

In general the heart rate is much increased, and cardiac dilatation of greater or lesser degree occurs, while the blood-pressure falls, but naturally symptoms and signs will vary much with the degree of poisoning and with the condition of the heart prior to its occurrence. It appears clear, moreover, that only those with sound hearts develop chronic cardiac diseases as the result of carbon monoxide intoxication, the others being killed off. Hence the greatly increased risk to the individual who has a cardiac lesion.

Considering for a moment the results of electrocardiographic and clinical examinations, the conclusions come to by Stearns, Drinker and Shaughnessy [19], who in 1938 made examinations of this nature of twenty-two patients who had been poisoned by illumination gas, are important.

These were as follows :—

(1) Carbon monoxide asphyxia, even though severe enough to cause death, may produce no important electrocardiographic changes.

(2) Changes in the T-waves and in the S–T segments occur most frequently.

(3) Paroxysmal auricular fibrillation may appear in patients within the age-group in which any physiological insult or trauma may cause this condition.

(4) One case of transitory intraventricular heart block occurred in the series.

(5) No cases of auricular ventricular heart block definitely attributable to carbon monoxide poisoning were found.

As regards the blood-vessels it would appear that carbon monoxide has but little effect except in severe cases of poisoning, but in these the fragility of the capillaries is undoubtedly increased. This is borne out by the evidence of autopsies at which changes are likely to be found in the blood-vessel walls, and also by the fact that instances of thrombosis, embolism, and capillary hæmorrhages at times are seen.

A number of observers report also the occurrence of a reddish skin coloration in the form of pink patches on the breast, the inner surfaces of the thighs, and the cheeks.

The effects of acute poisoning with carbon monoxide on the nervous system are of the greatest importance, these being due primarily to the anoxæmia produced.

The reactions seen will depend largely upon the rapidity of development of asphyxiation. Tetanic convulsions, grinding of the teeth, and biting movements of the jaw may be seen, while the eyes may protrude and roll. Vomiting, defæcation, urination, erection of the penis with ejaculation, may also be met with. Such symptoms will not, however, be seen so frequently in patients who have suffered from a prolonged period of asphyxia. This is stressed by Drinker, as also the fact that there is likely to be a great variation between the symptoms of the man who has been unconscious for some hours due to inhalation of a low percentage of gas, and of the individual who has been rapidly poisoned by a high concentration.

In the former a greatly lowered temperature and serious dislocations of vital chemical equilibria are likely to predominate, while in the latter, and though on the verge of death, neuro-muscular reactions may be very rigorous.

The author mentioned also refers in his book to patients supposedly suffering from dementia præcox or other forms of insanity who have been proved ultimately to be cases of carbon monoxide poisoning.

It might be well to mention here that though convulsions are looked upon by many as a common symptom in intoxication with the gas under discussion, yet they are not perhaps of as frequent occurrence as is supposed. It is reported that many men found dead from carbon monoxide poisoning have been in a natural position, some of them still holding tools, food, etc., in their hands. Apparently, however, convulsions are more frequent with exposures to high concentrations of the gas over 0·5 per cent.

They also occur at times in recovering patients. It should be borne in mind that the symptoms of anoxæmia in many respects resemble drunkenness, and that often a patient suffering from carbon monoxide poisoning has great confidence in his own sanity and only realizes the true state of affairs later. Also a patient possibly brought to the verge of unconsciousness may think that nothing is wrong, this being particularly the case with poisoning by high concentrations.

We should now turn to a consideration of the more immediate effects of severe carbon monoxide intoxication on certain other systems and organs of the body, those symptoms of later development being dealt with in due course in connexion with the third stage or sequelæ.

In mild poisoning albuminuria and casts in the urine are quite frequently found but tend to disappear within some forty-eight hours. In severe cases, and after prolonged unconsciousness, occasional instances of acute renal disease have apparently been reported, while paralysis of the bladder with retention of urine is not unknown.

Drinker, summarizing the available evidence, states that glycosuria will be found in practically all severe cases of carbon monoxide poisoning and that it may be present for eight to twenty-four hours, occasionally for three days, and very rarely for a week. There is, however, no valid evidence that poisoning of this nature causes diabetes or that diabetics experiencing this form of asphyxia are made worse by it.

As regards visual symptoms, the patient may see flashes of light and black specks before his eyes, usually just prior to the supervention of total blackness, while dimmed vision is of frequent occurrence and early in appearance.

The earliest and most constant sign of carbon monoxide poisoning is stated to be congestion of the retinal veins and hyperæmia of the optic disc.

Auditory disturbances are often noted prior to the patient losing consciousness. They usually assume the form of whistling, ringing, or thumping noises, though other varieties of such disturbances may be met with.

Dizziness has already been mentioned as a very common symptom and one of the earliest to be noted. In severe poisoning, also, anæsthesia, partial or sometimes complete, of certain areas of the skin may occur, either early or later, and the ability to feel pain may be much reduced before consciousness is lost. On this account it is not uncommon to find that persons poisoned severely may be badly burned or otherwise injured.

The effects of carbon monoxide poisoning on the brain and cerebrospinal fluid are of considerable interest, and it is noteworthy that the pressure of the cerebrospinal fluid is invariably increased and that cerebral œdema is also present. It is the combination of these two changes which is responsible for the acute headache which is a feature of this form of intoxication.

Drinker quotes experiments of Haldane [20] and Forbes [21] which showed that headache, though commencing during inhalation of the gas,

is worse during the recovery period, and that maximum congestion of the retinal vessels occurs during this time.

Finally, it must be remembered that in many cases there is a very definite fall of body temperature, and although its occurrence, together with a fall in the metabolic rate, are useful to some extent owing to the diminished oxygen demand of the tissues, yet the appearance of this sign is definitely of ill omen.

This lowering of temperature was one of the more characteristic effects of carbon monoxide poisoning in British troops during the War, and a reference to "The Medical History of the War" gives evidence that even in mild cases the patients complained bitterly of cold. This state of affairs was much more marked in severe poisoning and added to the difficulties of treatment, especially if the shafts and galleries of a mine were wet.

Recovering patients may go to the other extreme and the pyrexia may be high and last for a few days. Drinker considers that this usually signifies damage to the brain.

We must now devote our attention to those later developments of acute carbon monoxide poisoning which are included in the third or sequela stage.

Dealing first with the nervous system amnesia is of frequent development after recovery from unconsciousness, and the patient cannot remember what happened prior to his being poisoned. Confusion may also accompany the amnesia.

Leschke [22] stresses the fact that criminal acts may be performed during the confusion state. He quotes the case of the captain of a ship who had inhaled charcoal fumes in his cabin and shot the ships' boy who came to wake him, and that of a signalman who killed his wife and injured his sister-in-law and who only escaped the penalty of the law owing to the finding of carbon monoxide in the blood from his wife's body.

It would seem that in some cases it may be days or even weeks before cerebral disorders appear, and during this time the patient may feel quite well.

Mental disturbances are not dependent upon the severity of the poisoning and may occur in slightly poisoned patients. On the other hand, as stated by Leschke, they are usually present in victims who have been unconscious for days. It is of some moment to realize also that mental symptoms may be intermittent in their appearance and not continuous.

Psychotic changes due to carbon monoxide poisoning are very variable in form and are again sometimes continuous and sometimes intermittent. Raving madness, attacks of destructiveness, and all stages of excitement may be found on the one hand, and acute depression, apathy, dementia, and the like, on the other.

Drinker, referring to the duration of a psychosis consequent upon carbon monoxide poisoning, states that it is usually in accord with the original severity of the poisoning.

Mild cases may show mental symptoms for several weeks only. More serious cases showing complete dissociation and confusion, amounting

practically to coma, may exhibit mental symptoms for months or even permanently.

Drinker emphasizes the point that improvement invariably starts a short time after the onset, and follows a fairly rapid course to complete recovery or to the final permanent condition.

In discussing the incidence of permanent mental and neurological disease after poisoning, he points out that in a study of 21,143 cases over a ten-year period in New York City, permanent damage of this nature could only be found in thirty-nine patients. All of these had been severely poisoned and had records of long periods of unconsciousness, and none was an instance of chronic poisoning. In thirteen cases there was a clear period of seven to twenty days preceding the onset of symptoms.

Carbon monoxide poisoning is a generalized asphyxia, and it is not to be wondered at that there is an extraordinary variation in the mental and nervous manifestations of this intoxication, and apart from those already mentioned there are others which may occur.

Hypertonia of the muscles, increased deep reflexes, ankle clonus, Parkinsonism, etc., due to the effects of the poison on the basal ganglia, may all be seen at times. Wrist-drop, toe-drop, skin anæsthesias and the like are described, but these peripheral nerve manifestations are stated by Drinker to be less characteristic of the neurological sequelæ than is some degree of Parkinsonism.

Finally, patients occasionally show hemiplegia, due usually to a cerebral thrombosis. As already indicated, the amount of nervous damage done is apparent very early in the course of the case and the maximum effect is reached very quickly. Drinker considers that some degree of improvement may confidently be expected during the first two years, but that after this time the changes are established permanently and no further improvement can be contemplated.

As regards sequelæ of acute poisoning in connexion with the special senses, a number of cases of permanent damage to vision are on record almost invariably as the result of severe poisoning with long periods of unconsciousness, the lesions being usually due to damage to the nuclei of the ocular nerves.

Permanent damage to hearing occurs very rarely, while as regards smell and taste lasting interference with the functions of these organs of special sense is practically unknown.

Temporary affections of the taste and smell are stated by Leschke to be common, while temporary disturbances of hearing are of frequent occurrence.

Dizziness, although in a large proportion of cases an early symptom, very rarely persists for any length of time.

As in the case of brain and nerve damage, cardiac sequelæ definitely attributable to carbon monoxide poisoning are rare. Drinker quotes a case of what seems to be the commonest type of cardiac sequel—a patient with dyspnœa and cardiac enlargement who died suddenly eleven months after

being poisoned. Unconsciousness at the time of poisoning had lasted three days, but after recovery his pulse was regular though rapid till death.

At autopsy on macroscopic examination nothing was found except dilatation of the heart. The patient had, prior to being poisoned with carbon monoxide, been in the best of health.

Sudden death of cardiac origin consequent upon exposure to carbon monoxide is comparatively common, and is believed to be due to ventricular fibrillation ; the situation would seem to be that acute poisoning will kill a fair proportion of individuals with healthy hearts, but only those with absolutely sound cardiac organs will produce the few cases of chronic cardiac disease definitely attributable to carbon monoxide poisoning. Those with defective hearts invariably succumb to the poison.

A few words are necessary on the subject of pneumonia as a sequela of carbon monoxide poisoning, especially as a number of such cases among British troops were reported during the War.

In most of these it is stated exposure had been prolonged and the percentage of carbon monoxide in the air, though not large, was sufficient to cause prolonged oxygen starvation of the lungs and nervous tissues. The disease apparently was a rare development following short exposures to high concentrations of the gas.

Notable features of pneumonia as a complication of carbon monoxide are [23] : (1) Its development normally within four days of exposure to the gas and very often in the right lung ; (2) it is almost always lobar in type except when caused by nitrous fumes in addition ; (3) it is extensive in distribution and runs a rapid course ; (4) the pulse-rate is out of all proportion to the temperature, which is frequently low ; (5) The heart collapses with great rapidity.

The possible appearance of a reddish skin coloration in certain areas has already been referred to. On these patches at a later stage persistent herpes may develop or large blebs followed at times by sloughing.

Bed-sores, too, develop easily in severely poisoned individuals, while the occurrence of œdema is by no means unknown.

Drinker considers that trophic phenomena of the nature mentioned are due rather to an underlying neuritis than to any other cause, and states that in his experience serious phenomena of this nature are quite uncommon.

This brings to a conclusion our consideration of the more important sequelæ of acute poisoning with carbon monoxide with the exception perhaps that mention should have been made of the occurrence in a small proportion of cases of sexual impotence, probably cerebral in origin ; while, as animal experiments quoted by Drinker would seem to indicate, there may also be in some patients adverse effects on testes or ovaries resulting in loss of fertility.

The reader will realize that with a general intoxicant such as carbon monoxide the effects may be manifold, and that all that has been attempted by the writer is to tabulate those signs and symptoms of this pathological condition which are the most likely to be met with.

(*To be continued.*)

TREATMENT OF GONORRHŒA AND SOFT CHANCRE IN EGYPT BY SULPHONAMIDE.

BY MAJOR L. B. CLARKE,
Royal Army Medical Corps.

WITH A NOTE ON THE BLOOD PICTURE

BY MAJOR D. W. BEAMISH, *M.C.*,
Royal Army Medical Corps.

THE introduction about two years ago of chemotherapy into the treatment of gonorrhœa and its more recent adoption for that of soft chancre. are milestones on the road of medical progress and rank with the discovery of salvarsan. Both gonorrhœa and soft chancre in the absence of a specific drug have proved for many years problems of the first order whose solution appeared to be well-nigh impossible.

The former, through its incidence and chronicity, accounted for more bed space in our military hospitals than any other disease and much loss of man power to the Army, and the latter in lesser degree also presented a very difficult problem.

The discovery of the prontosil group of drugs has completely altered the outlook, and the barometer is set fair for further progress.

In view of the fact that the only account so far published in the Journal relates to work done in England, it is thought that a record of the observations carried out during the last nine months in Egypt may prove of interest to those whose professional duties may include the treatment of venereal disease.

The opinions expressed are purely personal ones, and are put forward very largely for the purpose of inviting criticism or confirmation.

The drug used has been Messrs. Burroughs Wellcome's Sulphonamide in 0·5-gramme tablets.

GONORRHŒA

For purposes of comparison it is interesting to note briefly the previous attempts made in this Centre to lower the average stay in hospital. It must, however, be borne in mind that the Citadel Military Hospital at Cairo by no means provides ideal accommodation, and that conditions in this old building are not favourable for rapid recovery, and it is expected that the average time to cure gonorrhœa will always be greater than elsewhere.

On my arrival in this country in 1935 the average stay in hospital proved to be the very long one of seventy days.

Two types of experimental treatment, originated by me, were carried out :—

(1) In 1935-36 irrigations by saline 1 per cent and sodium sulphate 5 per cent took the place of potassium permanganate. Previous experience in Rangoon and Aldershot had convinced me of the value of the alternative treatment, and two communications on this subject had already appeared in the Journal [2], [3], and had been commented upon by the *British Medical Journal* [4], [5], and the *Military Surgeon* [6]. In Cairo this treatment brought the average stay in hospital down to 55·3 days, a much longer time than in previous stations.

(2) In 1936-37 this form of irrigation was continued, and protein shock in the form of increasing doses of intravenous T.A.B. at four-day intervals was instituted and lowered the stay in hospital to 43·3 days.

These two forms of experimental treatment are recorded as showing that some effort had been made to cope with the problem, and that some improvement had taken place although the figures were still very high.

This was the situation existing at the time of the introduction of sulphonamide.

In April, 1938, there was a small stock which had been ordered for the general wards, and in view of the publication of two articles, one by Dr. A. J. Cokkinis [7] in the *British Medical Journal* and the other by Lieutenant-Colonel O. J. O'Hanlon, [1] R.A.M.C., in the JOURNAL OF THE ROYAL ARMY MEDICAL CORPS, it was felt that a trial should be made in Cairo.

A number of old-standing chronic cases were selected, and the treatment met with immediate success, forty-one cases out of forty-five leaving hospital after a ten-day course and successfully passing their test for cure.

The results were so encouraging that a stock of 75,000 doses was asked for. In the meanwhile I had the opportunity, whilst on leave in England, of discussing the problem with Lieutenant-Colonel O'Hanlon, who stressed the point that the dose had to be pushed almost to toxic limits to effect a cure, an opinion amply borne out by the subsequent work in Cairo.

The observations which are now recorded commenced at the beginning of July, 1938, and cover a period of nine months. The details of dosage and administration largely follow those recommended by Lieutenant-Colonel O'Hanlon.

STANDARD COURSE OF TREATMENT.

The standard course of treatment consisted in administering the drug by the mouth four times daily at evenly spaced intervals: 6 a.m., noon, 6 p.m., and midnight.

The following number of tablets were given per day: 12, 12, 12, 12, 8, 8, 8, 6, 6, 6.

This constituted a ten-day course which commenced two days after admission.

The diet consisted of a fairly generous "light" diet from which was excluded eggs and onions, owing to their sulphur content. Aperient salts were withheld for the same reason, and cascara or castor oil substituted.

The question of irrigations naturally arose as there was no guidance on this point from any of the publications on the subject.

The plan finally evolved was to avoid irrigations within the first five days. If, however, the discharge was not at that stage clearing up, 1 : 20,000 potassium permanganate was started. Saline and sodium sulphate irrigations have not so far been used owing to the complicating factor of sulphur, although the amount absorbed cannot be very great.

Although this was the general scheme of treatment which the majority of the patients received, it was, however, modified in a minority of cases in two ways : (1) A few cases did so well that treatment was suspended after five or six days with complete recovery ; (2) cases showing complications of a severe type were stopped permanently, and of a mild type temporarily.

The test for cure adopted for all cases was the routine one of previous years : Case " dry " for four days, cessation of all treatment, two bottles of beer a day for two days, one cubic centimetre of gonococcal vaccine, and a prostatic massage. If the case were then still absolutely " dry," discharge from hospital took place two days later. It is thus seen that a period of eight days was allowed before the man was returned to his unit. All men were recommended four days' excused duty and three days' light duty, and given a warning to avoid alcohol, violent exercise, and all excitement of a prejudicial nature. Cases reported to hospital weekly for a surveillance lasting from six weeks to two months.

For the first five months of the period under review differential blood-counts were done by Major D. W. Beamish on the fourth and eighth days of treatment to maintain a check on the condition of the blood. One case only suggested the onset of agranulocytosis. The scheme was modified in the last few months to the extent of only doubtful cases being tested, as it was by this time considered that the clinical picture in the ordinary course of events provided an adequate safeguard.

Major Beamish has kindly written a short account of this work for inclusion in this article.

Results.

The results have far exceeded anticipation and are analsyed in Table I. This shows the number of courses necessary to effect a cure and the average stay in hospital. The total number of cases treated by sulphonamide is 224.

Table I.—Analysis of Gonorrhœa Cases Treated by Sulphonamide.

Number of ten-day courses	Number of cases	Average number of days in hospital	Relapses	Days in hospital with relapse	Complications: Cyanosis	Temperature	Rash
One course ..	150	18·8	27	27	132	70	16
Two courses ..	52	44·7	6	34	47	17	Nil
Three courses ..	21	69·8	1	90	20	4	Nil
One long case ..	1	89·0	Nil	Nil	1	Nil	Nil
	224						

Classification of Results.

(1) *Good results*, requiring ONE course, 150 cases leaving hospital in 18·8 days.

(2) *Fair results*, requiring TWO courses, 52 cases leaving hospital in 44·7 days.

(3) *Bad results*, requiring THREE courses, 21 cases leaving hospital in 69·8 days.

(4) *One long case*, requiring FOUR courses, and leaving hospital in eighty-nine days.

Notes on the Above Classification.

(1) *Good Results.*—These 150 cases, which did very well, were nearly all " dry " on the fifth day, the gonococci having disappeared from the smears by the third day. Some cases were actually " dry " on the third day, i.e. after only two days' treatment.

(2) *Fair Results.*—These 52 cases cleared up soon after the second course with a stay in hospital of 44·7 days, and probably represent an average time without sulphonamide.

(3) *Bad Results.*—These 21 cases required three full courses and remained in hospital 69·4 days.

These and the one very long case naturally prompt the question as to why they have not responded to treatment, and this point is discussed below. Twenty-seven cases relapsed and were in hospital twenty-seven days.

Discussion on Sulphonamide Failures.

At the outset there was no special factor observed which might in any way distinguish these men from those who made a quick recovery, and the reason remains somewhat of a mystery.

In order to try and discover any common factor in these cases a careful perusal of the clinical notes was made, and it is interesting to observe that: (1) They had nearly all been out in Egypt more than two years. (2) Their average service was about six years, i.e., within a short time of completing an average engagement. (3) They were nearly all above the average age of the serving soldier. Many were rather senior N.C.O.s.

By contrast, those who did best were mostly young soldiers, and these went out of hospital in from fourteen to eighteen days.

Alcohol, employment, previous general condition, and place of origin of disease were all considered, but appeared to have no bearing on the subject, and the only conclusion so far arrived at is that generally speaking the younger soldiers do better than the older.

It would be a matter of great interest if other medical officers who have had experience of sulphonamide could throw any further light on this subject as it is definitely one about which we are at present very much in the dark.

Complications due to Treatment.

There were three main varieties of complications due to treatment and several minor ones. Taken in order of frequency there were :—

(1) *Cyanosis.*—Most of the cases became cyanosed in varying degree, no less than 200 out of 224. The shade varied from a faint blue to a deep plum colour, especially marked on the lower lip. The fainter shades were regarded as normal, but the deep plum colour, especially when associated with an ashen grey coloured face, called definitely for cessation of treatment. A curious point is that headache and giddiness were often absent in severely cyanotic cases.

(2) *Temperatures.*—91 out of 224 cases developed temperatures varying from 100° to 103°, usually about the fifth day, but quite often just at the end of the course. The drug was always stopped, the fluid part of the diet increased, and the temperature fell to normal within twenty-four to forty-eight hours. In some cases a second course was given after about ten days' rest with no apparent harm.

(3) *Rashes.*—16 cases developed rashes. They showed at about the fifth to ninth day on the extensor aspect of the arms and forearms, the front and back of the chest, and less frequently on the face. The rash consisted of small, polymorphic, discrete macules. The colour varied according to the degree of cyanosis from pale blue to deep plum. In those with no cyanosis it was pink. No papules were seen. This complication was regarded as a definite toxic sign and sulphonamide was stopped permanently. An increase in the fluid part of the diet by soda water and lemonade and a further additional quantity of barley water appeared beneficial. The rashes in all cases cleared up in three days and the patients seemed none the worse. The differential diagnosis of these rashes from those of syphilis and the exanthemata would afford an interesting intellectual exercise.

(4) *Minor Complications.*—In order of frequency these were: (*a*) *Headache :* Most patients complained of varying degree of headache which came to be regarded as almost normal, and no treatment was given as it appeared unwise to add a further depressant drug to sulphonamide. If, however, any reasonably safe analgesic is known, such information would be welcomed. (*b*) *Constipation :* Many cases became very constipated, partly through being in bed. As the saline aperients contain sulphur they were withheld, and cascara or castor oil substituted, many soldiers having a preference for the latter. (*c*) *Vertigo :* It was a common feature in many cases for attacks of sudden giddiness to be reported, especially when getting out of bed. This did not call for any special attention other than to issue a warning to go slowly. (*d*) *Pain in Chest and Stomach :* This was uncommon and was said to resemble heartburn and disappeared with bicarbonate of soda. Only a few cases of vomiting occurred.

All complications cleared up well after three days, and except for rashes did not constitute a contra-indication to a further course if such were necessary.

It should, however, be realized that a highly toxic drug is being used, that there is a fine and variable margin between cure and danger, and that the nearer one approaches to cure the greater is the danger. Each case therefore, requires careful observation, and a daily review of the degree of toxicity and its relation to the progress of the disease.

Cases on sulphonamide should definitely be in bed throughout the course and a strict control of the drug maintained to ensure that it does not fall into unauthorised hands.

As a further measure of safety all cases were kept in bed for at least two days after cessation of treatment, during which time the special egg-free diet was continued.

Complications of Gonorrhœa Arising During Treatment.

Two cases of epididymitis occurred; a great improvement compared with previous forms of treatment. These complications are particularly common in the East and often require a long period for recovery. It is striking testimony to the new drug that so few of these complications occurred.

There were two cases of arthritis, one of which was severe and was invalided to England.

There is no doubt that sulphonamide cuts down the incidence of epididymitis, but it had no effect whatever in preventing the case of arthritis, which had to be invalided. This case is referred to below as one which at an earlier stage had developed double ophthalmia.

Cases of Ophthalmia.

Two cases of double ophthalmia arose during treatment. One was the arthritis case referred to above, and it is thought that this was of metastatic origin. Both these eye cases made dramatic recoveries as regards the ophthalmic signs with four days of sulphonamide treatment at the rate of twelve tablets a day. The usual routine local treatment was, of course, carried out as well.

Relation between Dosage and Body-weight.

Occasionally the dosage was reduced for men of small physique. On the other hand, a corporal of one of the Guards' regiments, who was 6 feet 5 inches in height and weighed 17 stone, did not appear to be doing well on the routine dosage and it was thought that he was not getting sufficient for his body-weight. On the third day, after two days of twelve tablets each, the dosage was increased for the remainder of his treatment as follows: 15, 16, 16, 16, 16, 16, 16, 16. He thus had 151 tablets representing a total of 75·5 grammes of the drug. He was " dry " on the fourth day and did very well. This case is recorded as showing the very large dosage which may be tolerated by a big man. Only slight cyanosis occurred.

Soft Chancre.

With the full possibilities of sulphonamide still unexplored, it was thought that other diseases in a dermatological centre might react favourably, and in the absence of a specific drug for soft chancre this disease was selected for experiment.

This condition as seen at home and abroad would appear to be almost two different diseases, certainly as regards incidence and response to treatment.

At home it is a comparatively rare disease, abroad it is common, forming 106 cases out of a total of 665 admitted to the Citadel Military Hospital last year.

At home it tends to clear up fairly quickly, abroad it is definitely a chronic condition, often accompanied by buboes of a painful and intractable nature.

Our chief assistance in the past has come from dmelcos, which given intravenously clears up a number of cases in a satisfactory manner, but its value is limited and somewhat uncertain, and it has not been used very much in this centre recently.

During the past year sulphonamide was introduced for the soft chancre cases at the same time and in the same dosage as for gonorrhœa.

The results are summarized in Table II. It should be pointed out that the word " routine " for the first six months does not include dmelcos, so that sulphonamide is not compared with this drug.

TABLE II.—EFFECT OF SULPHONAMIDE ON SOFT CHANCRE.

Period		Treatment	Number of cases	Number of days in hospital
January—June, 1938	..	Routine	35	28·0
July, 1938—March, 1939	..	Sulphonamide	111	15·8

It will be seen that sulphonamide caused a reduction in the length of stay in hospital from an average of 28 to 15·8 days.

As these cases were naturally all under observation for syphilis, saline was given as a local dressing for four days and then eusol. The dark-ground tests and later the routine Wassermann or Khan tests were all negative, and after the usual three months' observation and tests these cases were finally diagnosed soft chancre.

It is interesting to note that two cases of syphilis, closely resembling soft chancre with negative dark-ground tests, were placed on sulphonamide with no effect whatever on the sores. At a later stage the blood-test proved the presence of syphilis, and as a matter of interest further dark-ground tests were done. The spirochætes then seen were numerous, active and healthy, so it was definitely established that sulphonamide has no power over the spirochæte nor does it appear to affect the blood-test in any way.

A further interesting point emerged from these two cases. The dark-ground fields, although showing plenty of spirochætes, were entirely clear of other organisms, debris, and extraneous matter. It seemed as though sulphonamide had cleared the ground for the spirochætes.

One of the most satisfactory features of sulphonamide in cases of soft chancre is the dramatic fashion in which commencing buboes clear up and disappear often in forty-eight hours. No case of bubo arose during treatment. The relief of local pain is also a prominent feature.

If sulphonamide had done nothing else than eliminate epididymitis and buboes from our venereal practice it would have formed a veritable milestone in medical history.

It is also to be noted that whilst there was a varying degree of response to the drug there was not the wide discrepancy between good and bad results as there was in gonorrhœa. In fact most of the cases reacted very favourably and without complications.

A final interesting point emerged during the course of the nine months' observation, and this was the "discovery" that sulphonamide may be applied locally to the sores, either during or after the course of treatment. As it is only slightly soluble in water it is probably mostly in the form of a suspension. It remains on the sore for some time as a caked white powder very much like calamine lotion. The results are nearly always excellent and sometimes dramatic.

It would seem that sulphonamide is really far more effective in this disease than in gonorrhœa, and its usefulness in soft chancre has been obscured by the comparative incidence of the two diseases.

Conclusions.

Sulphonamide in doses sufficient to produce a certain degree of toxicity is shown to be a most powerful agent in the treatment of gonorrhœa, two-thirds of the cases leaving hospital in less than nineteen days, the remaining third failing to respond to the same extent, and a few appearing to be entirely unaffected by its administration.

In soft chancre also excellent results were obtained by the drug when given on the same lines as for gonorrhœa, but with less uncertainty as to cure and less toxicity.

It is thus seen that we have now at our disposal a group of new drugs, one of which at any rate has very marked therapeutic powers.

M & B 693 has recently been taken into use in this centre, and while it is too early to draw definite conclusions from the small number of cases so far treated, two effects appear to be emerging: (1) Excellent results with some cases; (2) during the hot and humid weather now prevailing in Egypt several cases have developed severe rashes, one of which was the most marked I have ever seen.

If this or any other new drug in this group should be found to have equal therapeutic powers and be less toxic, the problems which have for long beset the path of the dermatologist may recede into the limbo of the vanished past.

Note on the Blood Picture.

By Major D. W. Beamish, *M.C.*,
Royal Army Medical Corps.

The following is a résumé of differential blood-counts performed on gonorrhœa and soft chancre cases under treatment by sulphonamide :—

Total number of counts	..	..	..	330
Number of patients	..	..	..	187

Out of the 187 patients there were 33 who showed a lymphocytosis. 6 of them being over 40 per cent and one 68 per cent.

14 cases had a polymorphonuclear leucocytosis, i.e. 80 per cent.

8 cases had a eosinophilia, i.e. 7–12 per cent.

3 cases had a monocytosis (increase in the large hyaline cells), i.e. 15–20 per cent.

Perhaps the most interesting point arising out of these blood-counts is the fact that only 17·6 per cent showed any abnormality in the differential count in spite of the fact that large amounts of the drug were given and a number of the patients developed symptoms such as cyanosis, high temperature, and rash.

The first abnormality usually noticed under the microscope was a diminution of the percentage of the polymorphonuclear leucocytes and a corresponding relative increase in the mononuclear variety.

In general the cases which had complications had a lymphocytosis and in one case only was there a definite tendency to the condition of agranulocytosis.

On the whole we have found it useful to have routine counts done as a check on the treatment, but as clinical experience of these cases increases and as the pathologist becomes more conversant with the blood pictures, the number of routine tests may be cut down considerably.

After a little practice one can inspect a well-stained film in a few minutes, and at a glance the picture is sufficient to decide whether or not any gross abnormality is present.

In other words a complete differential count worked out in mathematical detail is not necessary.

In two cases treatment was stopped and in one case reduced, as a result of the blood-counts.

The cause of the eosinophilia cases is not accounted for. A concurrent helminthic infection was a possibility.

Where leucocytosis and lymphocytosis are mentioned the increase is presumed to be relative, as in only a few cases were total counts carried out, and these showed little or no change, or some increase, due to the disease and intensity of infection, etc.

ACKNOWLEDGEMENTS.

Acknowledgements are made to Colonel P. S. Tomlinson, D.S.O., M.R.C.P., D.D.M.S., British Troops in Egypt, and to Lieutenant-Colonel J. Higgins, R.A.M.C., Officer Commanding the Citadel Military Hospital, for permission to submit this article for publication.

Acknowledgements are also due to Major D. W. Beamish, M.C., R.A.M.C., A.D.P., British Troops in Egypt, for carrying out the bacteriological tests and for contributing to this article, and finally to Private H. Richardson, R.A.M.C., the Special Treatment Orderly, whose work in looking after the cases has been of the utmost value.

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Dr. JAMES BARRY: INSPECTOR-GENERAL OF THE ARMY MEDICAL DEPARTMENT.

By Colonel N. J. C. RUTHERFORD, D.S.O.

My interest in the history of James Barry was first stirred in 1932 when I was at the Cape of Good Hope, as it should still be called. Lunching one day in Wynberg at the old Dutch homestead of Alphen, the ancestral home of the Cloete family, the conversation turned on past personalities and events connected with the history of Alphen. My hostess asked me if I knew the story of Dr. James Barry, the surgeon who served in the Army Medical Department for forty-six years, attained the rank of Senior Inspector-General, and at death was discovered to have been a woman! It appeared that Barry was a friend of the Cloete family and frequently visited Alphen. Be that as it may, it apparently did not prevent the fiery little officer from fighting a duel with a Captain Cloete who at the time was an A.D.C. to Lord Charles Somerset, the Governor of the Cape. I was then shown the actual place where the duel was fought. Following up this strange story, I found in the Dictionary of National Biography an account of this astonishing personality. The facts are tersely set down in these words:—

"Barry. James (1795–1865). Inspector-General of the Army Medical Department, a woman who passed through life as a man, is said to have been the grand-daughter of a Scotch Earl. Entered the Army as a Hospital Assistant, attired as a man, 5th July, 1813, and maintained the assumption of manhood all her life."

Then follow the dates of her promotions in the Service up to the rank of Inspector-General on December 7, 1858, and retirement on half-pay in 1859.

"Served at the Cape as Staff Surgeon to the Governor, Lord Charles Somerset." She is then described as "The most skillful of physicians and the most wayward of men, in appearance a beardless lad, Scotch type of countenance, reddish hair and high cheek-bones. There was an effeminacy in his manner which he strove to overcome. His conversation was greatly superior to that usually heard at the mess table. Fought a duel at the Cape. Was of a quarrelsome temper. Guilty of breaches of discipline. Sent home under arrest on more than one occasion. Offences always condoned at Headquarters. Died in London at 14, Margaret Street, on 25th July, 1865. Official report sent to Horse Guards that Doctor James Barry, late Senior Inspector-General, was a woman. It is said that neither landlady nor black servant who had waited upon her for years had any suspicion of her sex. Her motive said to be love for an army surgeon."

So much for the dry details of this astonishing story. Now, to confirm the above, listen to extracts taken from an Irish paper preserved in the Headquarter Mess of the Royal Army Medical Corps. It is headed:—

"A STRANGE STORY

"An incident is just now being discussed in military circles so extraordinary that were not its truth capable of being vouched for by official authority the narration would be deemed absolutely incredible.

"Our officers quartered at the Cape between fifteen and twenty years ago remember a certain Doctor Barry attached to the Medical Staff and enjoying a reputation for considerable skill in his profession, especially for firmness, decision and rapidity in difficult operations. This gentleman had entered the army in 1813, had passed of course through the grades as Assistant Surgeon and Surgeon in various regiments and had served in various quarters of the globe. His professional acquirements had procured for him his promotion to the Staff at the Cape. He was clever and agreeable save for the drawbacks of a most quarrelsome temper, and inordinate addiction to arguments which perpetually brought the former peculiarity into play. He was excessively plain, of feeble proportions, and laboured under the imperfection of a ludicrous speaking voice. Any natural 'chaffing' with regard to them, however, especially roused his ire and was at length discontinued on his calling out a persevering offender and shooting him through the lungs. (*Note*.—This account may be some garbled story arising from the Cloete duel at the Cape.)

"On promotion to Medical Inspector he was equally distinguished by his skill and his pugnacious propensities, the latter becoming so inconveniently developed that at last no notice was allowed to be taken of his fits of temper."

This somewhat long-winded extract goes on to paint poor Barry as an irritable, peevish little person, constantly fighting with all and sundry, but at the same time admitting his high professional attainments. It finishes with a statement that Barry left a letter, or made a verbal statement before death, that he wished no post-mortem to be made upon his body. This request would seem to be unlikely from the point of view that Barry wished to keep his secret even after death, as he would be well aware that the ordinary preparations for burial would undoubtedly disclose the true sex.

The article finishes as follows :—

"It stands an indubitable fact that a woman was for forty years an officer in the British Service, had fought one duel and had sought many more, had pursued a legitimate medical education, had received a regular diploma, and had acquired almost a celebrity for skill as a surgical operator. There is no doubt whatever about the fact, but I doubt whether Miss Braddon herself would have ventured to have made use of it in fiction !"

Among the records preserved is another of quite a different type and confirming in a strange way the essential fact that Barry had highly aristocratic connexions. Whether based on blood relationships or no it is difficult to say. The second paper quoted from is one from the North of England, and is typical of the political feelings expressed in the Press of the day.

"LORD X'S STRANGE VISITOR.

"The death was lately announced of a certain Doctor Barry who, fifteen or twenty years ago, was quartered at the Cape and had since 1813 risen to a high standing as an Army surgeon. It now appears that the Doctor was a woman! Doctor Barry only the other day inhabited —— Castle as a guest of the Earl of X., and paraded our streets and piers, or took a morning drive with Miss Y. of D. Many of our Town readers will have a distinct recollection of the person referred to. It will be remembered that upon her last visit she was attended by a black servant of singular acuteness. The complexion of 'Sambo' contrasted in a remarkable degree with the pale, sallow look of his mistress, and still more remarkable was the contrast between the lady and servant in point of stature as well as in minor respects. Their appearance in public naturally excited considerable attention. The attenuated form of the 'lady' was generally understood to be due to a vegetarian diet, and many were the jokes that were passed at the 'Doctor's' expense during her ladyship's sojourn at the Castle, when, according to custom, preparations were made for the celebration of what is known as the feast of the 'Political Passover' on the eve of a Trustee Election—when a few choice spirits meet together for the two-fold purpose of giving the old castle an airing and impressing the uninvited."

It is possible to reconstruct fairly accurately the life of this mysterious woman who undoubtedly served in the Army Medical Service with considerable distinction over a long period of years and was able to keep her secret until her death.

To one who has experience of Army life in the same stations where Barry has left a lasting memory it is possible to do so. At all events I propose to make the attempt.

My father, as an officer in the West India Regiment, served in British Guiana not long after Barry's period there, and in my childhood days I frequently heard him speak of strange happenings and peoples in that singularly unhealthy climate. As a medical man I can visualize and understand the conditions of medical education of Barry's time, and the extraordinary circumstances under which she was able to carry through her studies and qualify as a doctor, though of course at that time women were not admitted to the medical schools; and, having qualified, how did she obtain admittance to the Medical Service and overcome the delicate questions of the normal physical inspection necessary to pass the medical tests on admission! As is the case to-day, the candidates had to present themselves in a complete state of Nature before the examiners and be put through a searching test. Here are two difficult situations Barry had to meet; and how did she succeed in hoodwinking the College of Surgeons first and then the Medical Board that passed her as FIT FOR ACTIVE SERVICE as a hospital assistant in the British Army? And having gained admission, how on earth did a woman continue to conceal her sex during forty-six years of the rough and tumble of Army life in barracks, camps and troopships?

Firstly, I imagine Barry escaped the rough conditions of medical training of the day by being what was called " apprenticed " to some medical practitioner in Edinburgh who guided her footsteps through the years of study and enabled her to escape the life of the ordinary student who lived in very close contact with his fellow students in lodgings. Even in my own student days it was still the custom for certain students to reside with a doctor who lodged and fed them and from whose house they attended lectures and " walked the hospitals." After hours of study they could be as private as they wished. It was purely a financial arrangement, and as Barry from an early age was obviously well supplied with money, she could have arranged the details herself and taken up residence with her mentor without disclosing her true sex.

One cannot possibly picture one of Barry's sex carrying it off in the constant company of young men like Mr. Bob Sawyer and Mr. Ben Allen of that roistering, drinking age. In 1810 young women were supposed to be tender, shrinking flowers, liable to wither at a harsh word or a rough environment, who would be incapable of living with pipe-smoking, dram-drinking rowdies as the unfortunate medical student is depicted by Dickens.

So we must presume that Barry continued somehow to get through the years of study living a life excluded from the casual existence of her fellow students. But during that time there was obviously a romance of some sort as does not that solemn tome the Dictionary of National Biography say " her motive said to be love for an Army surgeon " ? Here is material to build up a love story between the shrinking, plain, red-haired girl in her manly disguise and some brave, handsome young fellow-student who " went for an Army surgeon " and possibly died on the field of battle unknowing that the gawky youth who forced his attentions on him was all the time a maiden in love. Or mayhap her lover had gone to foreign parts and Barry joined the Army in the hope that she could follow and serve in the same station as her beloved one. If this were so, the subject of this attack of calf-love got over it rapidly, as from her earliest days in uniform Barry paid marked attention to any prepossessing young woman she met and showed no desire whatever to form friendships with men. Indeed, she showed all her life that she was prepared at the slightest excuse to quarrel with men to the point of shooting them dead. Was this revenge for a slighted love in her young days, and was she an example of the inveterate man-hater somewhat rare in history ?

It is openly stated (in the extracts from the papers I have quoted), though I hesitate to repeat the scandal, that medical proof existed in the body of the dead Inspector-General that at some time in her life she had given birth to a child. If there were truth in this statement, it opens up the possibility of a tragic episode in Barry's life sufficient to sour her nature and indeed turn her into an enemy of the male sex. For this very reason she may have determined to meet man as his equal in a profession and use all her brains and arts to best him and make him suffer for what his sex had

imposed on her. So there was a reason for the picture we paint in later years of an embittered, hard little personage, using her authority to browbeat and bully presumptious young gallants who dared to oppose her orders.

Having made up her mind to join the Army, the next step was to circumvent the strict medical examination in some way. All her life rumour had it that she was highly connected, and in the Dictionary of National Biography she is " said to be the grand-daughter of a Scotch Earl."

We must assume that Barry had influence in high places and was able to bring powerful forces to bear when the occasion arose. Here was the opportunity. She knew that the Medical Board sat at Fort Pitt, Chatham, the Headquarters of the Army Medical Service. Some scheme must be evolved to meet the situation and Barry proceeded to take action. All candidates for the Medical Services would appear at a stated time for examination at Chatham. Before doing so she put in motion the strings which, if judiciously pulled, would get her accepted without undergoing exposure in both senses.

In 1813 medical men in private practice were not accustomed to their patients being prepared by nurses, as is the Harley Street custom of to-day. In fact, patients objected strongly to disrobing and exposing bare skin to cold draughts of air. Ladies would prudishly unbutton an inch or two of bosom and gentlemen an inch or two of waistcoat to allow the doctor to introduce the cold end of the periscope-like stick stethoscope to the chest and ask them to say " Ninety-nine please " ; or words to that effect. There might be a pulling up of skirts and pulling down of stockings, even a letting down of trousers in serious cases, but the point I wish to make is that the least exposure possible was made.

So a young gentleman in modish clothes presenting himself before that distinguished physician Sir John Dosing, and armed with a letter of introduction signed by a person of quality and position, would be treated with some deference and consideration. Sir John would simply be asked to give his opinion in writing that the bearer of the letter, Mr. Barry, was in such health and condition as to be fit for service in the Army as a Hospital Assistant. Sir John would ask questions, examine the eyesight, get Mr. Barry to go through certain bendings and twistings and turnings, to show he was supple of limb and active in his movements, and after the final ritual of the introduction of the wooden stethoscope between the buttons of Barry's smart waistcoat Sir John is prepared to state that the candidate is in full health and strength. Physicians of Sir John's eminence are not accustomed to mere routine examinations and signing of certificates, and he unbends his dignity merely because of the name at the bottom of that letter Mr. Barry has presented.

So down Harley Street trips the candidate and stops at the door of Sir James Cutting, the distinguished surgeon. The same procedure is gone through on the strength of the certificate lately written by Sir John Dosing, which Mr. Barry merely wants strengthened by the hand of Sir James on a

second and final certificate. Surgeons were impatient gentlemen not inclined to waste time over writing certificates when hundred-guinea operations were waiting for them, but as Dosing had signed, Cutting had no objection to endorsing such an opinion in a few brief words and Barry, emerging, trips off to the Horse Guards, where he hands in his application for admission to the Service accompanied by the certificates of the two great men to say he is a fit and proper person to hold the rank of Hospital Assistant. At the same time a letter has gone to a " high-up " person in the Horse Guards intimating from a not unknown person in society that a Mr. Barry, a person of some quality, was presenting himself at Fort Pitt, Chatham, on such and such a day for medical examination.

Situated between Chatham and Rochester on rising ground it fronted the main road from a considerable height, and behind it spread away open country known as the Fort Pitt Fields. Is not the site immortalized in " Pickwick Papers " when Mr. Winkle is challenged to fight a duel with " Dr. Slammer of the Ninety-seventh Regiment, Chatham Barracks," and invited to " turn into the field which borders the trench, take the footpath to the left when you arrive at an angle of the fortification and keep straight on," so as to present himself at the appointed place at the hour of sunset ; there to be shot at by Dr. Slammer.

So young Mr. Barry arrives at Rochester by coach, a young doctor aged 18 (if we accept her age as " about seventy " as given in the Register of Deaths when she died in London). This seems an early age to be a qualified doctor, and as she joined as a Hospital Assistant one may presume that at any rate she was at the time sufficiently educated to take that position. I believe it was fairly common in that time for young men to pass the necessary examinations before they arrived at the age when the degree could be conferred upon them, and they could practise their profession under the guidance of a qualified man until they could apply for their own documents. Also, much later than 1813, the unqualified student acted as Assistant to practising gentlemen of medicine and were paid as such, thus enabling young men of small means to pay their way until they could sit for their final examinations.

Be that as it may, here at Rochester, and probably at the " Bull Hotel," was young Barry, anxious for a career as a military doctor, well knowing that her sex would debar her from her intended life and yet determined, as she must have been, to conceal her sex and in no way allow it to prevent her from rising to the highest ranks.

In a lofty, panelled room in the Fort sits the Medical Board. The three surgeons are wearing blue military frock-coats, double-breasted and brass-buttoned, high stiff collars to the frocks fastening with metal clips, cross belts over the chest of black leather interspersed with strips of gold braid, and having at the back a pouch of the same material for holding a small case of surgical instruments, black and gold waist-belts, and sword slings. Swords were not worn at Medical Boards.

In the room is a soldier's six-foot iron-legged table, covered with a brown Army blanket. The senior member sits at the middle of the table in a windsor chair: a solid half-armed chair shaped to receive the posterior, but uncushioned. At each side sit the other two officers in stiff-backed Army chairs, plain, serviceable and uncomfortable. No human being could lounge in such chairs. At one side of the room is a tall instrument for measuring the height of candidates and near at hand is a bulky chair-weighing machine with a pyramid of black iron weights in various dimensions for counter-balancing the person to be weighed. At the far end of the room is a round white card covered with black dots on which a sort of shutter can be lifted or lowered to display a number as the examiner wills. Each black dot represents at a certain distance on the floor a target "bull's-eye" of a specified size. On the table are solid metal inkstands and heavy trays containing pens. The gold-braided, peaked caps of the three members are also on the table; small, hard, shallow caps with a steeply sloping small shiny black peak. Opposite each gentleman are three tall, bell-shaped wooden stethoscopes. The Surgeon-General is President of the Board. A serjeant of the Army Hospital Corps enters the room. He is dressed in a dark blue uniform and wears a shako. Saluting, he announces that "Mr. Barry is waiting to appear before the Board as a candidate for admission to the Service as a Hospital Assistant," awaiting the time when in two years he would be awarded the degree in medicine and surgery he had obtained and be eligible for the rank of Assistant Surgeon.

Before the President lie various forms and documents, and prominently displayed a large official letter, heavily sealed.

"Ask the young gentleman to wait a few moments, Serjeant. I will ring when I want him."

"Very good, Sir," replied the Serjeant as, saluting again, he leaves the room.

"Now, Gentlemen," continued the President, "I have here a letter from the Director-General himself who has also written me a demi-official letter on the matter of this young man who is to come before us. What it comes to is that the young man is highly connected and that the authorities at the War Office have requested the D-G. to simplify the usual routine medical examination and make it more or less a formal study of the documents in this letter I am to open and place before the Board."

So speaking, the President opened the letter and displayed to his members several medical certificates signed by names well known in the highest medical circles of London and the *haut monde* of the town. The certificates state that "Mr. Barry" had such a weight, height, had excellent eyesight, well-formed limbs, good teeth, was active and healthy in his habits and, in short, pre-eminently fitted to be an Assistant Surgeon.

The President puts down the papers and makes a little speech. Presidents must be able to make speeches and sway the Board, or what is the use of being an Inspector-General?

"I am aware, Gentlemen, that there is a certain irregularity in this proceeding, but being, as I am sure we are, anxious to meet the wishes of the Director-General, we can I think assume from these certificates, signed by such eminent names, that this Mr. Barry is in every respect well fitted for the position he desires to hold."

In the meanwhile, Mr. Barry was sitting in a small waiting room and conversing with the serjeant.

"What does this medical examination mean, Serjeant? What is one supposed to do?"

"Well, Sir, you strip naked, even to your socks mind, and the medical officers put you through tests to see if your joints are supple, your feet and ankles springy, such as hopping on one foot down the room and hopping back on the other, bending down to touch your toes, swinging your legs to see your hips is all right, and so on. When they have examined you to see you haven't no rupture, you know, cough and that, they sound your lungs and heart, examine your ears, test your eyesight. . . ."

"Thank you, Serjeant," interrupted Mr. Barry in his thin, high-pitched voice. "I don't think I shall bother them with all that. I have changed my mind. I do not want to be examined."

So said the elegant Mr. Barry in his blue surtout, grey pantaloons, strapped over very small shining Wellington boots with high heels, and a general elegance of carriage and demeanour. It was said in after years that Barry wore stiffly boned stays to give her form a manly shape and a firmness of outline and to conceal any softness of feminine curves, a fashion acquired without artificial restraint by her successors in the years to come; the production of that type of figure known as "straight up and down like a drink of water."

The serjeant was overcome at such lightness of demeanour in a prospective candidate for the Medical Services, and was about to use persuasion to induce the young gentleman to go through with the examination when the door opened and a Surgeon-Major appeared in person. The serjeant sprang to attention, but young Barry merely turned in his chair and gazed blandly at the elderly gentleman with the bristling eyebrows.

Advancing into the room the officer paused before the young man and, speaking in a harsh parade voice, said :—

"Am I addressing Mr. James Barry?"

"You are, Sir," replied Barry, with a nonchalant air.

"And is it your custom, Sir, to remain seated when a senior officer enters the room?"

"Invariably," answered this strange young person, who appeared to be not at all awed or impressed by seniority, "particularly as I am not yet aware that any officer can claim seniority in my case, being myself as yet a plain civilian."

The Surgeon-Major surveyed him with a disapproving eye.

"As far as I am concerned, Sir, you will continue to remain a plain

civilian, but I am ordered by the Surgeon-General to ask for your attendance before the Board. Follow me," and turning on his heel, the offended officer strode from the room.

With an indolent grace Barry rose and strolled down the corridor. The Surgeon-Major threw open the door of the Board Room and entered, followed by Barry, announcing curtly to the President :—

" Mr. Barry, Sir."

All three gentlemen now seated at the table surveyed the young man who had quietly seated himself in the chair placed so as to face the Board.

The Inspector-General opened the proceedings.

" I understand, Mr. Barry, that you desire to enter the Service as soon as possible ? "

" Such is my desire," replied Barry, " provided I am not put to whatever routine examinations and inconveniences which may be conceived necessary for *ordinary* candidates, but I have been informed by the Director-General that I am to be excused this routine. I hope such is the case, as I have to leave at once for London to join some friends proceeding to Scotland to stay with Lord Rathmullan."

Now this speech from a raw-boned, red-haired, beardless boy, speaking with a strong Scots accent and presenting himself as a candidate for the lowly, if honorable, position of a Hospital Assistant, fairly dumbfounded the Board. But at the same time it supported the hints and references in the Director-General's letter to " high family connexions, much influence in high places, etc.", and quite obviously impressed the Chairman.

The President was bland and diplomatic. The office of Director-General was in the gift of those who sat in high places and would it not be wise to acquire the reputation of " a good fellow ready to oblige " ; not a hide-bound official, sticking to strict regulations and red tape. A reasonable fellow who could shut an eye to the Book when higher authority indicated the way.

Turning to the members he spoke of the medical certificates that had been forwarded from the War Office and suggested that the Army Form passing Barry as " Fit for Service " should then and there be completed.

Barry swung an elegant boot and ignored the proceedings.

Barry was admitted to the rank of Hospital Assistant forthwith, and presumably hurried away to the " Bull Hotel " at Rochester and took the first coach to town.

Barry next appeared as an Assistant Surgeon at the Cape of Good Hope in the year 1815. The two years 1813 to 1815 may have been spent on half-pay, as there appears to be no record of any Home Service appointment, and it is probable that it suited her purpose to take up some medical work in London where she could live as she liked and not be forced into too intimate contact with young men of her own rank in the Service. It is possible her activities were directed to midwifery, as during her years at the Cape she soon established a reputation for great proficiency in that branch of her

profession. On appointment to the Cape Garrison, Barry must have made her way there by ordinary packet boat to escape the communal life incidental to the existence of a junior medical officer in a troopship, where she would undoubtedly be made to share the crowded quarters of the subalterns, something comparable to the life of a midshipman of the present day in a ship of war, a flat or passage-way where the young gentlemen sling their hammocks at night; keep their uniform in sea-chests; take their baths in a bathroom plainly furnished with wooden duck-boards and flat tin tubs slung to the deck when not in use, eat in the gun-room, and generally exist in closer contact than boys at a Public School.

Obviously such conditions were impossible for Barry, so she " wangled " a passage as a private gentleman going to the Cape in a passenger ship. She must have visited St. Helena, not yet the abode of the great Bonaparte in his enforced retirement from the world, but even then an important port of call for all shipping and in the hands of the East India Company. I wonder did she drive up from Jamestown and see the unpretentious house called "Longwood," where later an Emperor and his entourage would endeavour to maintain a stately existence in spite of Sir Hudson Lowe's insistence that " he only knew of a General Buonaparte being on the Island, and was unaware of any Emperor being a resident of his domain."

At the Cape the Military Headquarters were at the Castle built by the Dutch during their hundreds of years of occupation, and the Military Hospital was situated at Woodstock on the shores of Table Bay.

On a certain day in December, 1815, three young surgeons were sitting in the mess room of the officers' quarters at the hospital. Outside, the south-eastern was blowing, filling the air with sand and grit, and howling dismally round the inhospitable-looking long block of yellow painted houses facing a turbulent, white-capped Table Bay.

Assistant Surgeon Moriarity was sitting in a long cane chair. He was wearing an undress uniform of blue frock-coat with white linen trousers. He was at his ease with coat unbuttoned and was smoking a cigar. His two companions were dressed as he was and all three were freely damning and blasting the weather and the fact that they had to pay their evening visit to their respective wards at 6 p.m. instead of being free to get into plain clothes and ride away to the cool wooded suburbs of Newlands or Wynberg, away from the hot and exposed Woodstock.

" Who is for orderly officer to-morrow ? "

Moriarity asked the question, well knowing he was the officer designated for a twenty-four hours' permanent spell of hospital duty.

One of his brother officers simply pointed at Moriarity to save the trouble of speaking.

" And if I am, one of you two will be glad to exchange with me ? "

" What! No answer. And you know well to-morrow is the Race Day at Kenilworth. Sure, you wouldn't have me stuck here, and me with a horse running in the second race ? "

A profound silence was his only answer.

"Well, of all the . . . ."

Moriarity stopped suddenly and slapped his hand on the arm of his chair.

"I have it," he continued. "The new man, Barry, comes in on the Packet to-day. He ought to be here any time now. I'll stick him for 'Orderly Dog' to-morrow and I can get away."

Hardly had he spoken when a two-horsed open carriage rattled up to the door and a black servant, descending from the box seat, opened the door to allow the occupant to emerge. The three officers rushed to the window and stared in great surprise at the equipage. It was one of the Government House carriages. Stepping out of the vehicle came a young man in the full dress of the Medical Service, but not exactly to pattern. There was a certain licence and variety in the costume that astonished the lookers-on. The arriving officer wore a cocked hat, a short blue tunic with a high stiff red collar, heavily splayed with gold lace, riding breeches descending into high black riding boots with very high heels, and he was wearing heavy cavalry spurs.

The gorgeous figure motioned to the servant, who, bowing respectfully, preceded him to the door and rapped smartly.

The three young men raised their eyebrows and gazed helplessly at each other. Who could this be ? It wasn't the Governor, Lord Charles Somerset, but surely it must be one of his staff sent to call or deliver a message or invitation to the mess.

A moment later a mess servant threw open the door and announced: "Assistant Surgeon Barry."

Into the room clanked a small, thin young man, his face long, with a pointed chin, well-shaped nose, small pursed-up mouth, large dark eyes, pale and freckled skin, crowned with a crop of red hair displayed as the gentleman removed his cocked hat, and speaking in a high-pitched voice announced himself with a forward bow.

"Assistant Surgeon Barry, come to report his arrival from England by to-day's Packet."

Moriarity was the first of them to recover his composure. Advancing with outstretched hand he said: "And welcome to the station, Barry. Sit down and make yourself at home. Can I order you something to take the dryness of this infernal dust out of your throat ?"

"I thank you, No," replied this stiff little person. "I am pressed for time. I am due to dine with Lord Henry Somerset. As you see, he sent his carriage to meet me. I merely wish to report myself to the Senior Medical Officer before I proceed to take up my duties as Staff Surgeon at Government House."

"Staff Surgeon !" said the astonished Moriarity. "Why, there's no such appointment. The Governor sends for one of us if he wants medical attention for himself or his staff."

" Such may have been the case," Barry coldly replied, " but from now on I am accredited to the Governor's household as his private Medical Adviser."

" And do you mean to say," shouted Moriarity, " that you will not live here at Woodstock and do duty at the hospital ? "

" Certainly not," was the reply. " My house has been selected for me, and I am going into occupation this evening, I believe," he went on calmly. " The Governor's A.D.C. has seen to all the necessary arrangements, horses, servants, and so on."

Moriarity threw himself into a chair and, producing a huge bandana handkerchief, mopped his steaming face.

" Well," he muttered, " if this doesn't beat all. And I hoping for a relief to-morrow. May I ask," he said, " will your services be available for such commonplace duties as orderly officer at the hospital ? "

" I think not," replied Barry, smiling on the hot and angry officer. " I imagine my duties at Government House will take up all my time, but perhaps, Gentlemen, you will direct me to the office of the Senior Medical Officer, where I can make my official report."

Moriarity rose from his chair.

" Come with me. I shall have great pleasure in introducing you to Surgeon-Major McNab, the Senior Medical Officer."

Striding down the passage with Barry tip-tapping along beside him in his high-heeled boots, Moriarity stopped at a door on which the letters S.M.O. were painted in black letters, knocked, and entered.

Surgeon-Major McNab was a tall, lanky figure of a man seated at his office desk. Looking up under his eyebrows he silently gazed upon the figure of this somewhat flamboyantly attired officer.

" And who," he said, " might you be ? "

Barry drew his small figure to its full five feet three, and saluted.

" Assistant Surgeon Barry, Sir. At your service. Arrived from England to-day and directed from the War Office to be attached as Staff Surgeon to the Household of His Excellency the Governor, Lord Charles Somerset."

" Indeed," said McNab slowly. " And where are the orders for this appointment ? I have received no such instructions beyond the fact that an Assistant Surgeon was to arrive from England for duty with the garrison."

Barry stepped forward and produced from an inside pocket of his tunic a long official sealed envelope, which he handed to the Surgeon-Major. McNab opened the document, and carefully perused the contents. It took considerable time. Moriarity was anxiously waiting for McNab to burst out into profanity and teach this jackanapes his position. But nothing happened.

McNab folded up the letter, replaced it in its envelope, and handed it back to Barry.

" This appears to be in order," he said. " You are accredited to the Governor's household as Staff Surgeon to attend on all his staff and such

persons in Government employ as are entitled to medical attendance. But I shall expect you to be under my orders for such other medical duties as I shall require you to carry out. Is that fully understood, Mr. Barry? And, by the way, who instructed you to wear that uniform? It seems to me to be more that of an A.D.C. than that of an Assistant Surgeon."

"I was informed at the War Office," replied Barry, "that I was to wear such uniform as would be suitable for a Governor's Staff, and not that of an ordinary Assistant Surgeon doing duty at a military hospital."

"And who, may I ask," said McNab, "gave you these instructions?"

"Well, Sir," replied Barry, "now you ask me it was the Adjutant-General with whom I happened to be lunching the day before I sailed."

"*Ind-e-e-d . . .* ," murmured McNab. "Indeed a high authority to discuss the uniform of a junior medical officer."

"Oh, just a family interest," replied the unaccountable young man. "He happens to be related to me through my mother's family."

"Aye, indeed?" said McNab. "Vairry interresting. Will ye dine with me the night?"

"I regret exceedingly, Sir, that I am ordered to dine to-night with Lord Charles Somerset."

"Weel, weel. Anither day perhaps. Ye had better be on your way then, Barry."

Moriarity accompanied Barry to his carriage and speechlessly returned to the mess room. His two friends were waiting eagerly to hear how the dour Surgeon-Major had treated Barry.

"What happened, Moriarity?" they cried in one voice.

"The divil a thing happened," said the overcome Irishman. "Barry is the son of a Scotch Duke, or the heir to an Earldom, or God knows what. All I know is, never a day's work do we get out of Mr. Royal Barry once he settles down in the Government House set."

So Dr. James Barry settled into his charming little house at the top of the gardens, close to Government House, and rapidly became a well-known figure in Cape society. Faint memories in the spoken word recall the picture of a small, dandified figure, always in high collared tunic and high black riding boots with exaggeratedly high heels, passing through the town riding a Basuto pony covered to the hocks by a fine net and led by a black servant, Barry sitting easily in the saddle holding a green-lined umbrella over his head. Whether his progress was always at a walking pace, one wonders. Certainly the outfit was not conducive to rapid horse exercise, but it may be the Basuto pony was a natural "trippler," that quick, tireless cross between a trot and a canter that the Basuto can hold by the hour, while the rider sits as easily as in an arm-chair. No doubt Barry covered ground at this pace as his servant ran before him like the running footmen of England. The Staff Surgeon would be in the position of a private medical attendant to the Government House "entourage" and to all recognized and salaried Government officials of Cape Town, and in addition would be charged with certain social activities connected with Government House entertainments.

What contact, if any, she had with the military medical authorities is difficult to compute. It being essential she should at all times avoid too intimate contact with her fellow men, I assume she used to the utmost the official position to cut herself off from any possibility of being ordered off to camp when the military carried out their customary trainings and " sham fights."

The way to do this was to make herself *persona grata* at Government House and obtain the ear of Sir Charles Somerset. Thus established, she could afford to ignore Surgeon-Major McNab and disobey any attempts the Senior Medical Officer might make to keep her under his orders. This affair would have to be put straight as soon as possible, and the occasion soon arose. The wife of an official was in an interesting condition, so interesting that anything might happen at any moment. The good lady had sent for the Staff Surgeon to advise on coming events, and was greatly surprised when what she called " a beardless lad, with red hair, high cheek-bones—an unmistakable Scotch type," arrived as her medical attendant. Soon, however, the dear lady became greatly interested in the skill, knowledge, and remarkable experience shown by this Scotch lad in all the numberless complaints connected with that interesting period. It was quite uncanny how her " dear physician" understood all she suffered and was so sympathetic and kind! Also, the physician's conversation was so sparkling, witty, and showed such close acquaintance with the Scotch and English aristocracy that it very soon became known in the social circles that Dr. Barry was related to the bluest blood of the old country, and from a delightful reticence in his manner when questioned more closely as to his family's connections with the Dukes and Earls he mentioned so naturally and easily in his conversation, it soon became whispered about that Barry was in fact the offspring of such a very important person at home that the name could not even be mentioned. Even later than 1815, it was not uncommon in our Colonies, as we called them, to find mysterious young men who evidently moved in high circles in England, as far as we could judge by their own accounts, but who never returned to the homeland, or received any visitors from their scenes of former glory, and about whom stories of " bar sinister," and " illegitimate," and " highly placed people " and " sent to the Colonies to be out of the way," quickly spread and soon became an established matter of history.

So to Barry's attractive personality and skill at his profession was attached that mysterious glamour of undisclosed parentage.

Now just at this time Surgeon-Major McNab forwarded a letter to Surgeon Barry notifying him that on a certain date in the near future he would be detailed as Medical Officer to the 83rd Regiment of Foot, proceeding up country to make a demonstration in the vicinity of Grahamstown, where a certain Kaffir tribe was giving trouble, and that " during his absence the duties of Staff Surgeon would be carried out by a Surgeon Moriarity."

The crisis had come.

Barry, that same morning, visited his lady patient and broke the news to her that he would not be present when that event they were preparing for came to its climax.

"What! Doctor Barry! Leave me to the care of one of the surgeons from the barracks? A man accustomed to the ailments of rough soldiers to come to my house. Who is it to be? Oh, Heavens! That wild Irishman from the bogs of Donegal. Truly an amusing character, but not my choice as a confidential medical attendant."

It was impossible—a scandal. Barry must *not* go. The Government must be told at once. Her husband would be sent to Government House the instant he returned from the Courts (he was a magistrate) and he would petition Lord Charles to cancel the absurd order. "Dr. Barry to be sent off into the wilds to purge and stomach-pump drunken soldiers. . . . Let that coarse Moriarity be despatched. . . ." And so on for some considerable time.

The train was laid and the match applied. An anxious husband interviewed Lord Charles. Having no wife—he was at that time a widower—the Governor was peculiarly vulnerable to feminine influence, and several charming ladies of the Government House circle approached him with petitions concerning the retention of Dr. Barry. Even the A.D.C., Captain Cloete, the son of a prominent old Dutch family, was loth to hear of any change of Staff Surgeon; so upsetting in every way. . . . Barry was very capable and easy in social matters, if one didn't upset his quick temper, a man of some social standing outside his Army position, and so forth. . . .

Also, Lord Charles was offended because the Senior Medical Officer had not approached him before sending an order to one of his, the Governor's, Staff. Barry might be an Assistant Surgeon of the Army Medical Service, but he was practically seconded as Staff Surgeon. This Senior Medical Officer fellow must be put in his place.

Barry was sent for and told by Lord Charles he was to remain at his duties and consider the order as cancelled. Then the Governor despatched a short note to the Officer Commanding the Garrison, pointing out that military officers on the Government House Staff were not under the order of the military authorities, etc., and that Lord Charles Somerset would be obliged if in future orders were not issued to such officers without his covering authority, etc., and, in fact, rapped the knuckles of the officer commanding the troops so sharply that he turned upon the Senior Medical Officer and wanted to know "What the devil he meant by giving orders without informing me," and so on. The result of course being that the Senior Medical Officer was so effectively crushed that never again did he dare to interfere with the Staff Surgeon.

(*To be continued.*)

Editorial.

A STATISTICAL STUDY OF APPENDICITIS.

In spite of the progress in many branches of medical science in recent years and the high incidence of appendicitis, colitis, gastric and duodenal ulcer very little is known of their causes. Medicine and surgery can bring great relief to patients suffering from these diseases, but too little is known about the predisposing causes to devise effective means of prevention. The literature on the subject deals with the technical methods of treatment of these diseases but inquiries into causation are rare.

The Medical Research Council have just published a report by Dr. Matthew Young and Mr. W. T. Russell on a detailed investigation of the mortality statistics of this and other countries, and of the statistics of certain hospitals. The object of this survey was to determine whether any useful information could be obtained from such data as to the factors which may influence the mortality from appendicitis and account for its prevalence at the present day. The figures relating to the frequency of appendicitis not only confirm that it is very prevalent, but show that it has been on the increase during recent years. The increase is real, and not due to greater knowledge and skill in diagnosis ; for instance, among the insured population of Scotland the annual incidence increased appreciably between 1930 and 1935, although this was not accompanied by any upward trend of the general sickness rate.

The national mortality figures show that in England and Wales there has been very little change during the last twenty years in the death-rate from appendicitis at all ages. The total annual mortality is of the order of 3,000 deaths, and the rate of mortality usually lies between 80-85 per million for males and between 60-65 for females. There is a rather higher incidence of mortality on the single woman than on the married. Mortality in the first five years of life and at over 45 years has definitely increased in the last twenty years, while at ages 5 to 45 there has been a considerable decline. The immediate cause of appendicitis is stated to be bacterial infection, but the causes which precipitate an attack are little understood. Stasis in the appendix resulting in the formation of stercoliths is probably an important factor in many cases. There is a certain amount of information which suggests that habits of life and, in particular, dietary habits, are of importance in predisposing to appendicitis. Rendle Short attributes its greatly increased incidence between 1895 and 1905 in this country mainly to change in the modern diet with a reduction in cellulose and fibre content, and an increased consumption of imported foods, especially meat. In support of this view it is stated that appendicitis rarely occurs in institutions because of the plain fare of the inmates, that it is also rare in primitive peoples living on a diet with abundance of cellulose, and it becomes common when such people change to European food.

The mortality from appendicitis resembles that from diabetes inasmuch as it decreases with descent in the social scale. In view of this class correlation it was of interest to study the history of the mortality during the War years to see if it bore any resemblance to that of diabetes. During 1915–18 diabetic mortality declined at the older ages, and the decline was attributed to lessened food consumption in that period, because when the food restrictions were lifted it increased again. To see if death-rates from appendicitis followed a similar course the examination was confined to the female mortality owing to the difficulty of obtaining the numbers of males exposed to risk. The rates declined at some of the younger ages, but the reduction at ages above 55 was more pronounced. The reduction in advanced life was similar to that for diabetes, but was only a temporary phase because the mortality in the post-war period at these ages increased appreciably. There is thus some indication that an excess of food, or possibly certain types of food, may play a part in the incidence of appendicitis.

The Report gives an interesting table showing the social distribution of the mortality from appendicitis. Five social classes are distinguished by the Registrar-General and the mortality amongst males in these categories at ages 26 to 65 years for the triennial period 1921–23 are shown, and in juxtaposition with the rates for appendicitis are the corresponding mortality rates for peptic ulcer (gastric and duodenal jointly). In appendicitis the mortality rate in the highest social class (Class I) is greatly in excess of that shown in the lowest social class (Class V), the ratio of the rates being nearly 5 : 2. The mortality rates in the intervening social classes show a progressive decline with the social order. The mortality from appendicitis thus falls with exceptional severity on people of high social grade. This divergence, as has been pointed out by the Registrar-General, cannot be attributed to varying efficiency in diagnosis, as such a varying efficiency would be found also in the case of peptic ulcer, and the table shows that the mortality in males from that disease *increases steadily* with decline in social status.

It would seem, therefore, that there must be real causes, whatever they may be, to account for the higher mortality experienced in the upper ranks of society. It is possible that the class difference is underestimated as the more prosperous classes would be more likely to have prompt and efficient treatment. Since the report was written the Registrar-General has issued the Occupational Mortality Supplement for 1930–32. He states that "appendicitis male mortality at 20–65 declined from Class I to Class V, the ratios showing no appreciable change since 1921–3. At ages 65 upwards proportionate mortality was four times as great in Class I as in Classes IV and V. Married women showed a similar relation with social class, though the range of mortality was somewhat less than for males." The relation of mortality to other diseases was investigated. Clinicians seem to hold very divergent views regarding the importance of appendicitis in the ætiology of peptic ulcer. Moynihan stated that there was evidence of some association in about 66 per cent of cases of peptic ulcer. The correlation between annual variations in appendicitis and diarrhœa mortality rates is shown to be of the

same order as that between the variations in mortality from diarrhœa and summer temperature. These are supposed to be organically associated, and it is possible that the equivalent degree of association in appendicitis and diarrhœa may be indicative of some common causal factor.

It was thought that there might be a relation between the mortality from appendicitis and the marital condition. A table is given showing the death-rate per million from appendicitis among women according to their marital state in England and Wales for the period 1911–20. For the whole group single, married, and widowed, the standardized death-rate was 54·8 per million ; for married women 53·7 per million ; and for single women 62·4 per million. This suggests a heavier mortality from the disease in single than in married women over 15 years of age. The table shows that the mortality of all the specific age-groups except 15–20 and 70–75 is lower in the married women, and that if the group above 75 is excluded the divergence is greatest in the middle period of life from 35–55 years. It is pointed out, however, that there may be selection of the fitter women for marriage, and that modern conditions may be less favourable to those women who to a large extent must support themselves.

The seasonal relation of the incidence of mortality was studied, and no evidence was found in the English data that the mortality has any relation to season of the year. In the figures for New York there is a suggestion that the mortality may be rather higher in summer and autumn than in the colder parts of the year. In contrast to appendicitis the mortality from gastric ulcer in England and Wales appears to show a relative excess in the colder seasons of the year.

Comparison of the available data regarding the relative frequencies of the various positions of the appendix in cases of appendicitis with those recorded for a long series of apparently normal cases, provides no definite indication that the actual position of the appendix in the abdomen bears any relationship to its liability to disease.

In an attempt to obtain further information regarding variations in the prevalence of appendicitis and in the mortality from the disease, the records of the largest hospitals in London, namely the London, St. Bartholomew's, and St. Thomas's, were extracted from about 1900 to the most recent year for which they could readily be obtained. The data show wide variation, not only with time, but also with source.

In regard to changes with time, comparison of the hospital records for recent and earlier periods in this country, in America and in Germany, shows a great decline in *the case fatality* from the disease. This apparent decline in the case fatality of appendicitis has been accompanied by an apparent increase in its *incidence.*

According to Hoffman the number of cases treated for appendicitis in 75 American hospitals has increased 44 per cent. as from 1923 to 1932. The increased incidence shown in hospital statistics might be explained as the result of increased resort to hospital. There seems, however, definite increase in the incidence of appendicitis. The relative constancy of the

mortality rate in this country, with the accompanying great reduction in the case fatality rate, can be satisfactorily explained only by an increased incidence of appendicitis.

As for the variation in fatality shown in different places, the figures for the Edinburgh hospitals suggest that taking the sexes together, the fatality in uncomplicated cases is about 1 per cent; whereas in frank general peritonitis it is 28–30 per cent; when appendicitis is complicated by abscess. approximately 6 per cent. The fatality rate for simple acute appendicitis in the Edinburgh data is rather less than the recorded rate in the London and St. Thomas's hospitals. But the inclusion of the separately classified cases of acute appendicitis with gangrene or perforation with the simple acute cases in Edinburgh gives a group of acute appendicitis which corresponds closely to the acute appendicitis class in the London hospitals: and in this group the fatality rates for each sex are in close agreement with the corresponding rates in the two London hospitals. In the most recent figures for the London hospitals the fatality in appendicitis with diffuse peritonitis varies from 19–24 per cent, which is rather lower than the rate for the similarly designated class in the Edinburgh hospitals, but the rates for appendicitis with abscess in males are of much the same order, as shown in the hospitals from the two cities.

Recent statistics from American hospitals show that the case fatality in uncomplicated acute appendicitis is usually under 1 per cent, and may be as low as 0·5 per cent; the fatality in appendicitis with diffuse peritonitis is usually about 30 per cent, and sometimes in excess of that figure.

Data published by observers in this country and in America show that the fatality rate from appendicitis appears to be largely dependent on the interval of time that elapses between the onset of symptoms and either admission to hospital or operation. There is convincing evidence that early admission to hospital is one of the most potent factors in reducing the fatality from the disease.

In the discussion on their paper, Young and Russell state that there has been a certain amount of propaganda urging a return to the kind of diet suggested by Rendle Short. But following this, no reduction in incidence, such as might be expected if Rendle Short's views are correct, has occurred, and Young and Russell think that under existing conditions of modern life it is improbable that a sufficient change in dietary habits will be introduced to influence in any appreciable degree the incidence of appendicitis. They consider that the only hopeful method of further reducing the fatality of the disease is to encourage, by the education of the public, earlier entry into hospital and the avoidance of purgatives or laxatives in cases in any way simulating it.

To summarize the main features of the report: it appears that there are 3,000 deaths a year from appendicitis, the fatality rate is declining, but the rate of incidence is increasing; there is a clear differentiation of mortality by social class; like diabetes the disease showed a reduction during the food restriction of the War period; it is particularly amenable to early treatment.

Clinical and other Notes.

NOTES ON THREE INTERESTING CASES.

By Major-General ROBERT PRIEST, K.H.P.

The annual reports compiled by the medical specialists in their respective stations for the year 1937 contained accounts of many cases of exceptional interest. From these, three have been selected not only because it is considered that they should be placed on record but because they have direct bearings upon our everyday medical practice in the Army. Firstly regarding the effects of trauma to the chest wall, it does not at first sight seem possible that a sharp blow over the precordium could cause a rupture of the underlying myocardium without accompanying damage to the ribs, but yet we find that it *is* possible, and therefore this type of injury becomes of medico-legal importance. Secondly, the account of the gastric polyp is reminiscent of "the stomach that swallowed its own polyp," and is quoted as another cause for hæmatemesis or melæna in the absence of demonstrable signs of gastric or duodenal ulceration, neoplasm or cirrhosis of the liver. Thirdly, attention has been recently called to the existence of polyarteritis nodosa (Leishman, 1937), and it is probable that more cases will come to light and this condition should be added to the list of diseases which can cause nodules or small cystic swellings in the subcutaneous tissues. This peculiar illness should be borne in mind especially when such swellings are associated with the presence of albumin, casts and blood in the urine. Acknowledgments are due to those medical specialists whose descriptive notes have made this publication possible.

(1) Trauma of Heart.

While playing cricket a young Indian Sepoy of the I.H.C., who was keeping wicket, was hit over the left breast by the cricket ball. After a short interval he continued the game on that day and played again on the following day until the match was ended. He did not complain of any pain until that same evening when he borrowed some liniment to rub his chest with. Some minutes later he was heard groaning as he lay on his charpoy, and when asked what was the matter he was unable to speak, and expired just before being placed on a stretcher to be taken to hospital.

At the post-mortem there was some bruising of the skin, but there was no fracture of the ribs. The pericardium was full of blood-stained fluid. The anterior surface of the heart was œdematous and showed some evidence of bruising. There was a small tear near the interventricular septum causing a communication between the right ventricle and the surface of the heart, that is, a rupture of the right ventricle. The coronary vessels and

aorta appeared to be healthy, and no other abnormality was found in the chest or in any other region of the body.

The effects on the heart of trauma to the chest wall may be fatal without any obvious lesion of the heart; there may be contusion or partial rupture of the heart; and lastly, certain irregularities of rhythm, valvular lesions and cardiac pain may also be sequelæ to injury to the front of the chest wall. Experimentally it has been shown that it is possible in the dead subject to rupture a cardiac valve by striking the chest vigorously but without causing injury to the bones of the thorax.

Amongst other instances (Barber, 1938), is the report of a boy, aged 6, whose chest was pressed against some railings by the shaft of a pony trap and one month later while out for a walk he collapsed and died. At the autopsy there was no external bruising but the left ventricle was ruptured posteriorly. In another instance, a boy of 9 years of age was knocked down and received multiple injuries. He died forty-seven days later, and a perforating slit was found at the auriculoventricular junction with hæmorrhage into the pericardium. In a third case, a child, aged 7, was brought into hospital dead; the front wheel of a car had passed over the chest wall without causing any external bruising or damage to the bones. At the post-mortem both ventricles were ruptured.

These instances, together with the one reported, serve to show that trauma can cause either an immediate fatal result or this unfortunate happening may occur within a few or after many days have elapsed since the receipt of the injury.

(2) An Unusual Gastric Polyp.

A soldier, aged 24, was admitted complaining of pain in the region of the umbilicus and vomiting during the previous three days. There was a history of "gastritis" and "duodenal ulcer" some three years before the onset of the present attack. Two days after admission he commenced to vomit "coffee grounds," and later he brought up increasing amounts of blood clot, which soon resulted in a grave anæmia necessitating a transfusion of 500 cubic centimetres of whole citrated blood. He improved after this but later was seized with severe pain in the region of the umbilicus, the abdomen became distended and rigid and it was decided to operate. No perforation or acute surgical condition was found at the operation, and the patient died on the following day. There was an irregular temperature of moderate degree throughout.

At the autopsy a small chronic duodenal ulcer was seen but in addition a polyp nearly the size of a golf ball with its pedicle attached to the pyloric region was found. The surface of the polyp was purple in colour and showed an area of ulceration which was evidently the source of the fatal hæmorrhage.

In a previous case seen by the writer a fatal melæna was the cause of death, and at the post-mortem the pylorus had "swallowed" the gastric polyp as it were, and this had bled freely into the duodenum.

(3) Polyarteritis Nodosa.

An officer, aged 28, who had served abroad for four and a half years in Europe, Palestine and China, was admitted to hospital in England in December, 1937, complaining of pains and cramp in the right flank.

He had been under treatment for influenza in the previous January, in February he was in hospital for muscular rheumatism, and in April for an acute attack of rheumatism involving both large and small joints, associated with some fever and tachycardia. Improvement was slow and he did not react very well to salicylate therapy. At this time there was no evidence of cardiac or other complications, the urine was normal but there was marked general weakness and debility, with hæmoglobin at 70 per cent and colour index 0·7. Wassermann reaction was negative. After a period of leave he did full duty until December of the same year when he was troubled by a maxillary sinusitis and a return of the muscular pains. After the antrum had been irrigated by his private doctor he collapsed and after a few days in bed was admitted once more to hospital. He was very weak, appeared anæmic and complained of pains which were sometimes very acute and were accompanied by cramp in the right thigh, hip and loin; there were some small lumps resembling cysticerci (*Tænia solium*) situated under the skin of the forearms, arms, abdomen and back; the heart appeared enlarged transversely and heart-rate was 100 per minute; there was tenderness in the right lumbar region and flank; the spleen and liver were not palpable. Neurologically, except for absent knee and ankle jerks, no abnormality was found. The urine contained albumin, epithelial and granular casts and some red blood cells. Leucocytes numbered 25,900 with polymorphs at 83 per cent. Optic discs were somewhat blurred and there were areas in the fundi suggestive of albuminuric retinitis. The day previous to the date fixed for removal of one of the subcutaneous cysts he suddenly collapsed and exhibited pallor, rapid pulse and much tenderness and resistance in the right flank, but there was no hæmaturia or melanæa. He rallied somewhat after a transfusion, but very shortly afterwards the internal hæmorrhage increased and rapidly proved fatal. At the post-mortem there was a large retroperitoneal hæmorrhage which appeared to come from a ruptured aneurismal dilatation of the right renal artery. There were many sacculations seen in the substance of this kidney as well as in that of the left. Macroscopically, portions of the kidney showed a number of small hæmorrhages of sizes ranging up to 1 cubic millimetre in diameter. Microscopically some of the vessels showed an aggregation of polymorphonuclear cells, together with eosinophiles and monocytes in the vicinity of the adventitia. In certain vessels aneurysmal dilatation was present and rupture had taken place with consequent hæmorrhage into the surrounding tissues. In other places hæmorrhages in various stages of organization were to be seen and although their connexion with an aneurysm was not obvious in the sections cut, there can be no reasonable doubt that this was their source of origin. Surrounding such hæmorrhages

eosinophile infiltration was a marked feature. Sections of the subcutaneous nodules showed the same characters.

Since polyarteritis nodosa was first recognized in the middle of last century as "a peculiar disease of the arteries which is accompanied by Bright's disease and progressive general paralysis of muscles," about 200 cases have been reported and in only a few of these has the diagnosis been made before death. Pathologically, whitish grey nodules are seen along the small and medium arteries of the kidneys, heart, liver, alimentary tract, mesentery, muscles, pancreas, peripheral nerves, skin and brain, in this order of frequency. These nodules may be of varying sizes and are really aneurysmal dilations which are apt to rupture, while in some thrombosis may occur leading to the formation of multiple infarcts. It is believed that the earliest change is in the adventitia with subsequent necrosis of the media and final proliferation of the intima of the arteries involved. The cause is unknown, but in a certain proportion of cases it has followed some kind of infection ; the cause has been ascribed to the action of a virus and alternatively, owing to its resemblance to acute rheumatism, it has been regarded as an allergic effect in a streptoccocal infection. The symptoms are the result of the combined effects of the presence of these arterial dilations, infarcts and hæmorrhages resulting in an alteration of blood supply in the regions affected. Briefly, these effects are fever, increasing general weakness, anæmia, tachycardia, muscular pains in body and limbs, with tender muscles, signs of a peripheral neuritis affecting any or all limbs with loss of reflexes and perhaps some sensory loss, albuminuria with casts and red blood cells, the presence of nodules about the size of a pea which seem to be fixed to the skin but movable over subcutaneous structures. Changes in the retinal arteries are unusual but albuminuric retinitis has been reported. There is usually a leucocytosis with a relative increase in polymorphonuclears. Diagnosis is usually made by examination of a subcutaneous cyst when the arterial nature of the latter is revealed.

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AN IMPROVISED LIGHTING SYSTEM FOR A FIELD AMBULANCE OPERATING TENT.

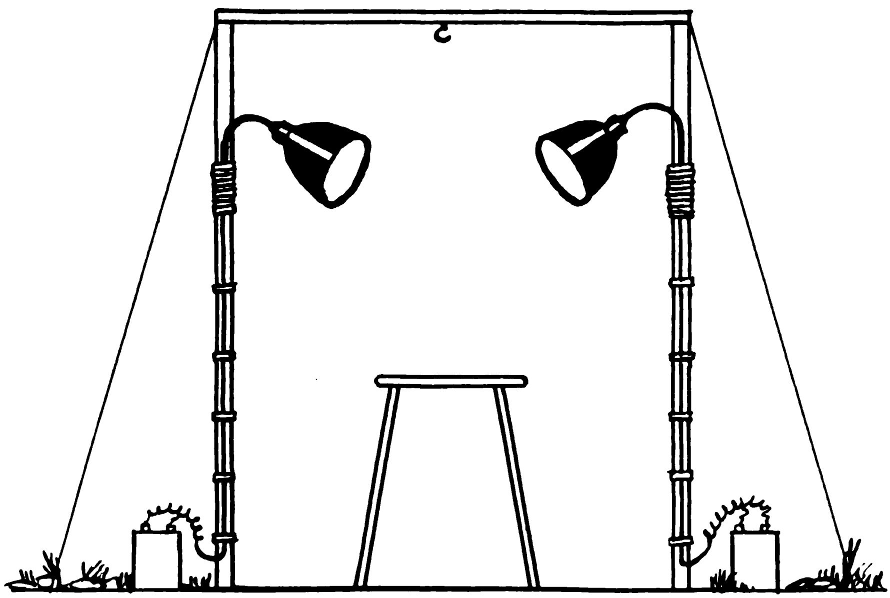
By Lieutenant P. G. TURPIN,
Royal Army Service Corps.

It is generally admitted that the type of acetylene light which is provided for operating tents of field ambulance units is inadequate, and, no doubt, a more suitable lighting system will, in due course, be approved and eventually form part of the permanent equipment of a main dressing station.

In the meanwhile, however, now that these units are mechanized, a simple but efficient lighting system can be improvised with the materials which already form part of the unit's equipment. The following materials are required :—

2 headlight reflectors 2 12-volt lamps (36 watt) 2 sets of 2 six-volt batteries	Such as are in use on the Morris 2-Ton Leader lorry.

25–30 feet of insulated electric wire.
3 feet of stiff wire.
1 roll of insulating tape.



All these materials can be provided by the M.T. section of the field ambulance and the whole system erected in less than ten minutes.

The batteries are kept outside the tent, the electric wires passing under the tarpaulin to the foot of the tent poles. The reflectors are fitted to pieces of stout wire, which are attached to the uprights with insulation tape ; the wire must be sufficiently pliable to enable the surgeon to manipulate the lamps easily and direct their rays where he requires them. The electric wires are fixed to the uprights with insulating tape, to prevent them impeding the work in the operating tent.

Echoes of the Past.

AN OUTLINE OF DENTISTRY IN THE BRITISH ARMY, 1626-1938.[1]

By Major S. H. WOODS, O.B.E.,
The Army Dental Corps.

Chronology.

1617: "Surgion's Mate," John Woodall; dental instruments in surgeon's chest.

1626: War with France—Woodall medical adviser—his chest becomes regulation pattern for the Army—July 10, Charles I authorizes free issue of chest—first authorized dental outfit for temporary Army surgeons and mates.

1626-1695: Musketeers (two-thirds of infantry) require incisors to open the bandoleer (powder charge).

1628 and 1639: Woodall's "Viaticum" giving uses and illustrations of the dental outfit for the Army surgeon.

1660: Standing Army formed—regular surgeons and mates—no details of instruments in chest.

1676: "Eight Chirurgicall Treatises," Richard Wiseman—first recorded gunshot wound of jaw (1650).

1678-1810: Grenadiers (one company per regiment) require incisors to open the fuse of the grenade.

1696-1865: The cartridge (combining charge and bullet) supersedes the bandoleer—all infantry required incisors and canines to tear open the cartridge.

1798: Hospital equipments laid down—one dental instrument.

1816: Report on Maxillo-Facial Injuries at Waterloo.

1820: Three dental instruments in equipment.

1821: Defective teeth as a cause of rejection.

1830: Odontalgia as a cause of admission to hospital.

1838: Four tooth instruments.

1857: Medical officers supplied with sets of extracting and filling instruments; requested to conserve teeth.

1878: Gutta-percha splint for fractured jaw added to equipment.

1880: British Dental Association formed—agitates constantly for Army dentistry, but without success.

1899-1902: South African War.

1900: Mr. N. Pedley, honorary dentist at Deelfontein, for six months.

1901: Four contract dentists for troops in the field. First issue of toothbrush.

1903-1908: Dentistry course to Royal Army Medical Corps officers—instituted at Guy's Hospital. Clinical teachers in dentistry appointed.

1904-1908: Eight contract-dentists appointed for Army in home commands.

1909-1914: Whole-time dentists superseded for part-time civilian contract.

1910-1914: Three contract-dentists for British troops in India.

1914-1918: The Great War. Slow recognition by authorities of the need for dental treatment at home and in the field; May, 1918, Lieutenant-Colonel Helliwell appointed to War Office in advisory capacity.

1921: January 4—The Army Dental Corps formed.

1932: Standing Army Advisory Committee on Maxillo-Facial Injuries formed.

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[1] Reprinted from the *Proceedings of the Royal Society of Medicine* by kind permission of the Honorary Editors.

PREVIOUS to the formation of the standing army in 1660, forces and their medical staff were raised under a system of contract for the duration of campaigns, men being roughly graded by physique for the various arms of the time. The infantry unit early in the seventeenth century was the

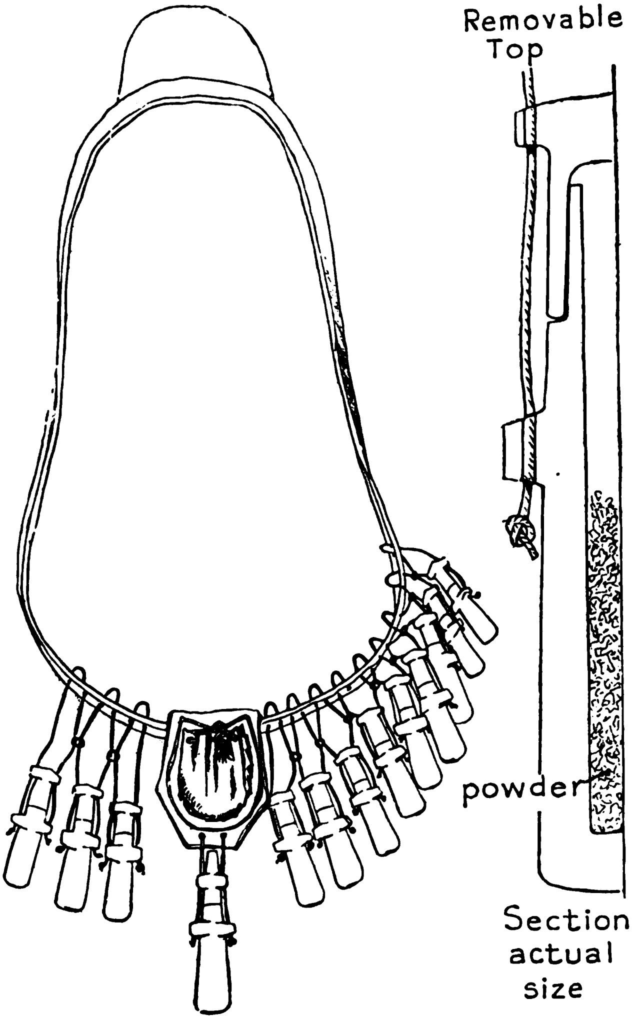

FIG. 1.—Bandoleers, shown in the cluster and full size. *c.* 1640. From " The British Army," Scott, 1868.)

company, 100 to 300 strong, one-third pikemen and two-thirds musketeers, the latter carrying the gunpowder charge in bandoleers—wooden tubes, four inches long, attached to a shoulder strap (fig. 1).

We read " It doth behove musquettiers to be strong and puissant of body, without sickness, achs, or other impediments " (Scott, 1868), but we are not told that it also behoved them to have front teeth wherewith to

pull off the bandoleer cap before pouring the powder down the muzzle. The use of incisors and canines as the quickest and simplest means to free the powder in the charge lasted till 1865, when the modern pin-firing mechanism was introduced, and for two centuries the possession of sufficient teeth for the purpose was the infantry dental standard, if we may call it such.

A surgeon and apprentice, styled "mate," were allotted to each infantry company, the former supplying his own chest of instruments and dressings, for which he received additional pay of twopence a month from each man. In his "Surgion's Mate," 1617, John Woodall, first Surgeon-General to the East India Company, details the contents of the chest required by the Company's surgeons, which soon became the regulation pattern for the forces and which Charles I, by Order in Council of July 10, 1626, authorized as a free issue by way of special inducement to surgeons to join his expedition against France. Woodall (appointed medical supervisor to the force) in a recruiting circular to the "younger sort of surgeons, my brethren" acquainted them of this Order by which the King not only increased the pay and field allowance of the previous reign, but "His Majestie moreover allowed and gave to each surgeon appointed to 250 men a surgery chest of £17 valew, free of account" (Gore, 1878).

We may therefore consider the instruments specified "for teeth" as the first authorized dental outfit (fig. 2)

First Authorized Army Dental Outfit—July 10, 1626 (Charles I).

Instruments	Modern counterpart
Paces	Crown forceps
Pullicans	Dislocating forceps
Forcers	Elevators
Punches	Chisels
Crowes bills	Root forceps
Flegmes	Periosteal elevators
Gravers	Scalers
Small files	Similar

Their uses are described, and some of them are illustrated, in Woodall's "Viaticum, or Pathway to the Surgeon's Chest," 1628, "containing chirurgicall instructions for the younger sort of surgeons in His Majestie's emploie," in which he tells us :—

"All these recited instruments, and each of them, are needfull in the surgeons chest, and cannot bee well forborne for the drawing of teeth, forasmuch as the cleansing of the teeth and gums, and the letting of the gums' bloud are often no small things for keeping men in health, and sometimes doe save the lives of men both at sea and land. For we see that from an Apostume begun under a rotten or hollow tooth, for want of drawing of the same, sometimes proceedeth great swellings in the face, or in the Amygdals and throat, and the party is suffocated and dieth."

Hence we see that scaling and gum treatment, in addition to extraction, were performed by the company surgeon, and we note the mention of extensive caries, with cellulitis of the face and fatal angina as complications of acute alveolar abscess.

On the downfall of the Commonwealth in 1660, the various forces in the three kingdoms, numbering some 80,000 men, were entirely disbanded, and a small standing army of about 5,000 was formed under Charles II. The temporary company surgeon was replaced by a regimental "chirurgeon" permanently attached to the regiment, supplying a chest of which

A NOTE OF THE PARTI-
cular Ingrediences due to the Surgeons
Cheſt, and of other neceſſary Appendexes
ſeruing for Chirurgicall vſes, whereof theſe next
recited may be placed on the lidde of the Cheſt,
if the Surgeon will haue it ſo.

Inciſion kniues.
Diſmembring kniues.
Catlings.
Raſors.
Trapans.
Leuatories.
Head-Sawes.
Diſmembring Sawes.
Diſmembring Nippers.
Mallet and Chizell.
Speculum Oris,
Speculum Oris with a Screw.
Speculum Linguæ.
Speculum Ani.
Cautrizing Irons.
Storks bills.
Rauens bills.
Crowes bills.
Terebellum.

Inciſion ſhieres.
Probes or ſlamules.
Spatulaes great and ſmall.
Spatulum Mondani.

For teeth.
Paces.
Pullicans.
Forcers or punches.
Crowes bills.
Flegmes.
Grauers.
Small files.

One bundle of ſmall German Inſtruments.
Gliſter Sirings.
Small Sirings.
Catheter.
Waxe Lights.

Theſe for the lidde of the Cheſt.

A The

Fig. 2.—Page 1, "Surgion's Mate." Woodall, 1617.

no details are available but in which some dental instruments were included, no doubt.

Richard Wiseman, "the Father of English Surgery," and most noted military surgeon of the Restoration, gives us two important army cases and also a vivid picture of oral surgery at that time, in his great work, "Severall Chirurgicall Treatises," 1676.

"One was shot in the Face betwixt the Nose and Eye on the right side into the Ethmoides by Pistol-bullet. After he had been cured some years of the external wound in his Face, he became troubled with a fretting Ichor, which was discharged by that Nostril; and especially at his first rising in the morning out of Bed it would run half a spoonful of a yellowish colour, which had made a chop or gutter at the lower end of that Nostril by its acrimony. After some years he felt, upon bending his head backwards or forwards, the Bullet to rowl to and fro over the roof of his Mouth. He complained to me of his grievance at the Hague in Holland, a little before his Majesty's going into Scotland. We resolv'd Upon the cutting thro' the Palat-bone, to which purpose I placed him in a clear light, one holding his head steady, while I cut into the roof. But the flesh was so close tied to the bone that it would not yield to my Spatula as I expected; wherefore I applied a bit of a Caustick-stone, and held it to the place with a pledget of lint a few minutes; by which I consumed the soft fleshy part over the bone, and afterwards cut into the bone such a hole, that in the moving of his head I could see the bullet lodged in the hole; which encouraging us to proceed in our work. the bullet was afterwards taken out, and he eased of that discharge of matter which threaten'd a filthy carious ulcer. My attendance upon his Majesty into Scotland hindring my prosecution of that cure, I left him in the hands of a Chirurgeon there, and since have often seen him at Court. But the Ulcer did not close up with a Callus; however the place is supplied by a small plate without offence."—Book IV: "Sinuous Ulcers in Gunshot Wounds."

This case may be dated, with some confidence, as having occurred in 1650, for Wiseman accompanied Charles, then Prince of Wales, from the Hague to Scotland in June of that year ("Dictionary of National Biography," 1900). It probably refers to a royalist officer wounded in the civil war, and subsequently attached to the Prince's retinue, and is the first recorded treatment of a gunshot wound of the jaws before the days of a standing army period. Of special significance is the mention of a prosthetic appliance subsequently used to close the resulting sinus into the antrum.

"An officer of the King's Regiment of Foot, marching at the head of his Company in a hot Summer's day, heated his blood and was seized with a pain in one of his teeth of the lower right Jaw. He sent for a Tooth-drawer, who pulling out the tooth breake the alveoli off from the jaw according to the length of it. . . . The neighbouring parts swelled and apostemated, and all his teeth and part of the alveoli cast off."—Book II: "Of Ulcers with Caries in the Bones."

The unfortunate officer reported to Wiseman, apparently consulting surgeon to the army at the time, who first attempted to cure the condition by fomentation, irrigation and drainage.

"We hoped the outward and inward swelling and discharge of matter would have lessened; but they not yielding one jot to our endeavours, I laid open the Cheek from the Orifice I had enlarged forward along the Bone, with intention to take it out; but it was so shut in, that I could by no means get it out, till with watchmakers files I cut through that Bone; then the ends thrust out into his Mouth. These I pulled out; they proved to be pieces of the Alveoli. Then I felt the Jaw itself arise; and, considering that if it was loose it must out, I passed the end of my Probe under it; whereupon it rose up, having been some while loose and was only held down by the aforesaid Alveoli; which being removed, the Jaw came away without the least pain or one drop of Blood, he only crying out of his Ear, as if it had made a hole through there."—*Loc. cit. supra.*

"The jaw being extracted, the side was ready to fall in; to prevent which I caused the patient to hold it stretched out with his fingers in his mouth and a looking glass held before him, that he might the better see to keep it more exactly even whilst I by agglutinative powders 'cum albumine ovi' made a Crust upon the outside; which with pastboard wet 'in aceto' applied over it sate close to it; and after it was dried kept that side of the cheek firm, and by bandage it continued so, he helping it as hath been above said. Whilst his chaps were thus bound up, I continued to wash his mouth with the decoction above said injected often in a day with a syringe; by which means the ulcer was cleansed and cured, and disposed to a callus, which grew and hardened in less than twenty days to equal with the other, as without looking in his mouth it could not be discerned."—*Loc. cit. supra.*

As the King's Regiment of Foot was one of the earliest in the standing army, this case may be regarded as the first recorded dental extraction and we specially note: (*a*) Osteomyelitis with loss of right angle and vertical ramus; (*b*) poroplastic splint to counteract the resulting displacement; (*c*) complete bony regeneration following on Wiseman's correct surgical procedure.

In 1678 grenadiers were introduced, and were required to have incisor teeth to open the fuse of the grenade—another use of teeth connected with arms of the service till about 1810, when grenades were discontinued.

The words of command and precise movements for freeing the powder in the bandoleer and grenade in 1690 were as follows:—

Musketeers.

Words of command	Explanation
No. 21: "Open them with your teeth."	"Bring the charger to your Mouth, pulling off the Cap with your Teeth and the help of your Thumb."
No. 22: "Charge with Powder."	"Bring your charger to the Muzzle, turning it up, pouring the Powder in the Barrel."

Grenadeers.

No. 12: "Open your Fuse."	"Bring the Grenade to your mouth with your Right Hand, tell 1, 2, open the Fuse with your Teeth."

(From "The Exercise of the Foot," 1690.)

(To be continued).

Current Literature.

CAMPBELL, DAVID, and MORGAN THOMAS, N. **Cyanosis Caused by Sulphonamide Compounds.** *The Lancet*, July 15, 1939.

During an extensive clinical use of p-aminobenzene sulphonamide and 2-p-aminobenzene sulphonamidopyridine the authors found cyanosis of varying intensity a frequent symptom. In cases treated with p-aminobenzene sulphonamide the pigment may be methæmoglobin or sulphæmoglobin, but more frequently the latter. On the other hand the pigment found during treatment with 2-p-aminobenzene sulphonamidopyridine is practically always methæmoglobin. Of thirty-two cases of pneumonia treated with this drug methæmoglobin was detected in the blood of twenty-five. and no case of sulphæmoglobin developed spontaneously despite the fact that no special precautions were taken to avoid purgation or sulphur-containing foods.

The characteristic absorption bands of both lie in the same vicinity of the red ; the spectrum-sulphæmoglobin band occupies wave lengths 615 $\mu\mu$ to 630 $\mu\mu$, and that of methæmoglobin 625 $\mu\mu$ to 655 $\mu\mu$. Cyanosis due to sulphæmoglobin lasts several weeks, whereas that due to methæmoglobin remains only a few days. When examining blood spectroscopically for methæmoglobin it is essential that the sample should be laked with only a small volume of water and examined soon after withdrawal. Otherwise the presence of the pigment may not be detected. In methæmoglobinæmia. whether produced by 2-p-aminobenzene sulphonamidopyridine, or by sodium nitrite, methylene blue is effective in causing the rapid disappearance of the cyanosis by converting methæmoglobin to hæmoglobin. The dye is active when given intravenously, intramuscularly, or by the mouth.

It is suggested that the routine employment of methylene blue in conditions calling for prolonged administration of 2-p-aminobenzene sulphonamidopyridine may be a useful measure in preventing cyanosis.

Methylene blue has no effect in preventing or modifying the cyanosis of sulphæmoglobinæmia.

CHEVALLIER, A. & CHORON, YVONNE. Sur l'existence de deux formes chimiques de la vitamine A : l'hémo et l'hépato vitamine A. [**The Existence of Two Chemical Forms of Vitamin A : Hæmo and Hepatovitamin A.**] *Arch. Méd. Gén. et Colon.* 1938, v. 7, 159–60.

The absorption curve of an alcoholic solution of vitamin A, prepared from a petroleum ether liver extract and irradiated with ultra-violet light, was altered in a precise manner. The photo-chemical destruction of a vitamin A extract from blood did not proceed in the same way. A further difference

between these two products is described. If liver is treated with anhydrous sodium sulphate and extracted with petroleum ether containing 4 per cent alcohol the residue after evaporation is quite insoluble in 60 per cent but soluble in 80 per cent alcohol. A similar extract of blood is completely soluble in 60 per cent alcohol. If blood is treated with alcohol to make a concentration of 60 per cent the vitamin A can be completely extracted with petroleum ether. On the other hand, saponification of either liver, blood, or cod-liver oil, followed by petroleum ether extraction, yields a product which is soluble in 60 per cent alcohol. It is postulated that vitamin A exists in two forms : (1) the hepatovitamin which is converted into (2) the hæmovitamin by saponification. Guinea-pigs with no vitamin A liver reserves were given an injection of the hæmovitamin. After twenty-four hours the liver contained 70 per cent hæmo- and 30 per cent hepatovitamin, but after forty-eight hours contained only hepatovitamin. The substance known as vitamin A is probably the form in which it is stored, and the hæmovitamin is the active form in which it is distributed to the tissues. H. N. H. GREEN.

Reprinted from " Bulletin of Hygiene," Vol. 14, *No.* 3.

BARDSLEY, Doris A. **The Bacterial Content of Ice-Cream in Relation to Manufacture, Storage and Standards of Purity.** *J. Hygiene.* 1938, v. 38, 527–46. [29 refs.]

Three methods of preparation are considered, viz. when all the ingredients are boiled, when only the milk and sugar are boiled, and when no ingredients are heated. Data are submitted dealing with the bacteriological examination of 237 samples of ice-cream of various ages. Following water analysis methods estimations were made of the number of organisms, coliform bacilli, fæcal streptococci of the enterococcus group and *Cl. welchii.* The tabulated figures show very wide variations for most of these estimations. Figures are also given for ice-cream manufactured in the laboratory by these three methods. The figures show that a great deal of contaminated ice-cream is offered for sale. Consideration is given to various bacteriological standards which have been advanced. The author considers that two standards (A and B) should be adopted. To satisfy standard A the sample must contain no *Bact. coli* in less than 0·1 cubic centimetre, the total counts must not exceed 200,000 organisms per cubic centimetre at 22° or at 37° C., enterococcus must be absent in less than 0·01 cubic centimetre and spores of *Cl. welchii* must be absent in 10 cubic centimetres. For standard B the respective figures are 0·01, 500,000, 0·001, and *Cl. welchii* absent in less than 10 cubic centimetres. Ice-cream samples which satisfy standard A may be considered " good," and those which satisfy standard B accepted but considered not very satisfactory. Those which are below standard B are unsatisfactory. [These are purely working standards as there are no powers to fix legal standards.] W. G. SAVAGE.

Reprinted from " Bulletin of Hygiene," Vol. 14, *No.* 3.

i. KAPSENBERG, G. Salmonellose bij den mensch, veroorzaakt door *S. enteritidis* var. *essen*, na het eten van visch (snoek). **[Poisoning by *Bact. enteritidis* var. *essen* after eating Pike.]** *Antonie van Leeuwenhoek Nederl. Tijdschr. v. Hyg. Microbiol. en Serol.* 1938. v. 5, 54–62. [17 refs.]

ii. JANSEN, J. Eenige opmerkingen betreffende *S. enteritidis* var. *essen* (Naar aanleiding van "*essen*" infectie bij den mensch na het eten van snoek). **[Remarks on *Bact. enteritidis* var. *essen*.]** *Ibid.*, 63–6.

i. The fish used on the occasion of this outbreak of food poisoning was the pike. It had been caught very easily and was non-resisting. Preparation of the fish was undertaken immediately and it was kept in a cool cellar overnight to be cooked next morning for the midday meal of seven persons. Nothing peculiar had been noticed about the flesh of the fish and it tasted good. About midnight all those who had partaken of the fish became ill with diarrhœa, vomiting, and abdominal cramps. Persons in the village who had eaten other fish than pike were not affected. Stools and vomit of the patients, together with remains of fish, all yielded in the laboratory examination cultures of *Bact. enteritidis* which agglutinated with specific serum. The strain isolated in all the cases was of the variety "*essen*."

Food poisoning by fish is not very common in man, and the variety of Salmonella—"*essen*"—has been associated with an infection particularly of ducks' eggs. In this particular case the fish used was in distress at the time of catching and was probably infected during life. The cooking was not sufficient to kill the bacteria already present in the flesh of the fish and the question arises therefore how had the fish itself become diseased. The suggestion is made that ducks, the carriers of this bacterial variety, had infected the water and the fish had become secondarily infected. This adds fish to the possible sources of food poisoning by *Bact. enteritidis essen*.

ii. A detailed examination of the isolated strain was made by the author who was responsible for placing it in the category of an "*essen*" variety. This variety is not entirely confined to the duck but is also found in chickens. It has now been found in fish. W. F. HARVEY.

Reprinted from "Bulletin of Hygiene," Vol. 14, No. 3.

WHITBY, L. **Chemotherapy of Bacterial Infections.** *Lancet*, 1938. Nov. 12, 1095–1103, 3 figs. [182 refs.]

This paper, which was presented by the author as the Bradshaw Lecture for 1938, contains a comprehensive survey of our knowledge up to the present date of the action of the various drugs developed from the original sulphamido-chrysoidin (prontosil) discovered by Domagk and his assistants in 1932. The extensive list of references should be valuable to those working in this field.

The historical development of the drugs is traced from the parent

substance, sulphanilamide, to which prontosil is reduced in the body, and the active products amongst the thousands tested may be grouped into (1) those in which a substitution is made in the amino group (e.g. proseptasine); (2) those in which an H atom of the sulphonamido group has been substituted, as for example by a pyridine group (e.g. M & B 693); and (3) compounds of sulphone type unrelated to sulphonamides (e.g. 4–4′diamino-diphenyl-sulphone). Since it is not clear what makes one compound more active or wider in its range than another, much tedious empirical trial is involved, progress being more rapid where suitable animal experiments are possible. The minor toxic symptoms noted are less serious than once supposed, so that it is rarely justifiable to stop treatment in serious disease likely to respond to the drugs, which usually act quickly if at all.

The first of the above groups, including sulphanilamide itself, is active against hæmolytic streptococci of Groups A, B, C, but not D or F, against meningococci, but not pneumococci except Type III, nor *Str. fæcalis*. Sulphanilamide is 0·8 per cent soluble at body temperature, the effect of one dose lasts for six hours, and it is excreted completely in the urine in twenty-four hours. The recommended adult dosage is 1 gramme per 20-pound body-weight (maximum 5 grammes) for the first two to three days of a serious infection, grading down thereafter. Toxic effects may be produced by 3 grammes daily. Agranulocytosis has been reported in eight cases which had received prolonged courses, six proving fatal. The author discusses the application of the drug to meningococcal infections, which in milder cases in the five to twenty year age-group can be cured by chemotherapy alone, but which respond better to simultaneous serum therapy in serious cases. In gonorrhœa, 10–20 per cent of cases fail to respond and a certain number become symptom-free with latent infection. The action of sulphanilamide on *Bact. coli* and a number of other infections is discussed. Proseptasine and soluseptasine are less toxic members of this group.

M & B 693 is the best known of the second group of drugs, which, in addition to enhanced action on the conditions upon which sulphanilamide is effective, possess a marked action on pneumococcal infection. It is much less toxic but its solubility is only 1 : 1,000, so that it is usually given orally, except where vomiting is troublesome. In pneumococcal pneumonia, 5 grammes are given in the first twelve hours followed by 1 gramme every four hours during the day to a total of 23 grammes in a week. Results of trials of the drug in meningococcal and staphylococcal infection in mice suggest a superiority to sulphanilamide, and in three cases of subacute bacterial endocarditis due to *Str. viridans* in man, clinical improvement and prolongation of life were obtained.

The drugs of the third group are effective, but too toxic for general use.

It is not clear whether the drugs are effective because of a bacteriostatic action enabling the defence mechanism of the body to eliminate the infection, or by neutralizing hæmolysins and leucocidins and stimulating phagocytosis. There is a lack of parallel between *in vivo* and *in vitro* experiments bearing

on this subject. The author, who is at present working with McIntosh on the relation of the drugs to immunity mechanism, indicates that they act not by leucocytic stimulation but by inhibition of multiplication of the organisms, preventing toxic depression of the marrow from overwhelming infection. Since the drugs are not specifically concerned with the immunity mechanism it would be unwise to jettison existing devices for producing specific immunity.

The "lag" noted *in vivo* and *in vitro* before bacterial multiplication ceases suggests that the drug is slowly adsorbed on the bacteria and ultimately blocks some receptor (in Ehrlich's sense), so that assimilation of food or of some factor essential for reproduction is hindered.

The paper concludes with certain observations on the development of resistant organisms, indicating that benefit might follow the use of a different drug if a recrudescence of infection requires a further course of treatment.

J. C. CRUICKSHANK.

Reprinted from "Bulletin of Hygiene," Vol. 14, *No.* 3.

CLAUBERG, K. W. Diphtheriebazillen-Typ-diagnose mittels eines neuen Verfahrens. **[The Type Diagnosis of Diphtheria. A New Method.]** *Zent. f. Bakt.* I. Abt. Orig. 1938, v. 142, 478-80.

A new medium is described for the type diagnosis of *C. diphtheriæ*. It consists of extract of potato, cystine 1 per cent, water blue (1·5 per cent solution), glycerol and 3 per cent nutrient agar. Plates are freshly prepared by mixing the potato extract with the other constituents before use. The medium is cheap, easy to prepare and very satisfactory for typing purposes. On this medium the *gravis* type grows as a large, flat, dry, irregular opaque colony of bluish colour. The *mitis* form as a thickish slimy, transparent grey-white colony, and the "intermediate" type as a small, colourless colony which needs a hand-lens to be properly seen.

C. C. OKELL.

Reprinted from the Bulletin of Hygiene, Vol. 14, *No.* 3

Reviews.

British Medical Societies. Edited by Sir D'Arcy Power, K.B.E., F.R.C.S. Pp. xvi + 312. With 48 Plates. London: Baillière, Tindall, and Cox. Price 10s. 6d.

In the preface Sir D'Arcy Power says that curiosity, which is a desire to learn, is an integral part of the intellectual make up of men. Originally it took the form of question and answer, but later it was elucidated by discussion, and men formed themselves into Societies.

In this fascinating book the life stories of thirty-four British medical societies, placed in chronological order from 1617 to 1925, will be found, and the various authors are to be congratulated upon the very readable way the subject matter has been presented. As one reads, men who were mere names in our student days become real live characters, for we read that Gilbert Blane, President of the Royal Medical Society of Edinburgh, was appointed Physician to the Fleet in 1780, and introduced lemon-juice as an anti-scorbutic, for, he wrote, fresh vegetables and lemon-juice are the only effectual anti-scorbutics. He also took a combatant's part in one of Rodney's battles, and worked a gun in the fore cabin till he was tired, and and later on in the battle Rodney was standing on the quarter-deck and with him was Gilbert Blane.

Sir James McGrigor, who was Director-General of the Army Medical Service from 1815 to 1851, figures largely as one of the keenest members of the Aberdeen Medico-Chirurgical Society; he was its first Secretary and maintained his interest in the Society throughout his successful life in the Medical Service of the Army. As an example of his keenness it is stated that he obtained by subscription from his brother officers a sum of no less than three hundred pounds towards the building of a meeting place for the Society. A photograph of his well-known memorial statue is included in the article dealing with this society.

How many of us remember that Dr. Matthew Dobson, the first President of the Liverpool Medical Society, was the first to discover sugar in the urine of diabetics?

The Reading Pathological Society, the oldest pathological society, founded in 1841, was very considerate to its members for we read that the date of meetings was chosen for the convenience and safety of country members to whom moonlight was helpful in driving home in their dog carts with oil lamps. This review must close with a good story about the late Sir William Osler's address to the York Medical Society. He expected a purely medical audience but he found that amongst his audience were the Dean of York and other divines, with many laymen and laywomen. After

the vote of thanks, Osler, in reply, apologized to his audience for having forgotten to give a popular address and said he feared they had suffered from a very dull lecture, but still they could have the satisfaction of not having understood him : for when attending lectures beyond his own understanding he (Osler) always felt the lecturer must be a man of considerable attainments ! Such was Osler's subtle wit.

Sufficient has I think been quoted to give an example of the interesting stories which are contained in the articles concerning these Medical Societies, and those who read them, whether medical men or historians, will be well repaid. The book is admirably illustrated throughout, but it seems that at the bottom of Plate XVI Edinburgh should be substituted by Glasgow. There is also a very serviceable index. R.P.

TREATMENT BY MANIPULATION IN GENERAL AND CONSULTING PRACTICE. By A. G. Timbrell Fisher, M.C., M.B., Ch.B., F.R.C.S. Third Edition. 1939. Pp. xiv + 256. 68 Illustrations. London : H. K. Lewis and Co., Ltd. Price 12s. 6d.

THE SCIENCE AND ART OF JOINT MANIPULATION. By Dr. J. Mennell, M.A., M.D., B.C.(Cantab). First Edition. Volume I. Extremities. 1939. Pp. xiv + 233, and numerous Illustrations. London : J. and A. Churchill, Ltd. Price 18s.

There is unquestionably a considerable field for treatment by manipulation in the Army surgeon's practice. The tendency to veil in mystery the doings of the " bone setter," or regard his methods as so much " hoodoo," is an attitude of mind adopted entirely by the uninformed lay mind. The medical profession has never harboured any delusions about the activities and the limitations of these unqualified men, and while we do not suggest that many of their undoubted successes can be attributed to advertisement, personality, self-assurance and abnormal manual touch and strength, we have appreciated the general need amongst us of closer study of anatomical facts and the effects of minor joint displacements and injuries, if we are to deal effectively with the class of case which can benefit from manipulative treatment. We owe it to Mr. Timbrell Fisher and Dr. Mennell, *inter alia*, not only that they appreciated the need of the profession for some authoritative pronouncements, but they have reminded us that in these two excellent works we should have all the requisite knowledge to enable us to treat such cases with equal and even more certainty of success. Both these books are excellent. Anatomical facts and appropriate methods in treatment are clearly stated and illustrated.

Mr. Fisher's book is smaller and will be found an excellent introduction to the subject, and ample for anyone who cannot afford the time to make a more detailed study of the subject. The first volume of Dr. Mennell's book (Extremities) makes one anticipate with pleasure the publication of

his next volume. These volumes will be found of most value to those who intend to make a more intimate study of manipulation.

It is a pity that a certain type of patient cannot appreciate fully the solid facts and good advice contained in these two works: the type of patient who imagines that a joint injury is the exclusive province of a bone setter or chieropractor. D.C.M.

THE STUDENTS' HANDBOOK OF SURGICAL OPERATIONS. By Sir Frederick Treves, Bt. Revised by Cecil P. G. Wakeley, D.Sc., F.R.S.(Edin.), F.R.C.S.(Edin.), F.A.C.S.(Hon.), F.R.A.C.S. Sixth Edition. 1939. Pp. xii + 563. London: Cassell and Co., Ltd. Price 12s. net.

The sixth edition of this volume has been brought up to date and contains new sections on the surgery of the sympathetic and nervous systems, and on certain orthopædic operations. A practical and concise account is given of the standard operations in surgery, and a very clear account of the principles and performance of the various amputations. The volume should prove of great use to those who are preparing for an examination in surgery.

T.P.L.D.

Correspondence.

HEAT STROKE AND ALLIED CONDITIONS.

TO THE EDITOR OF THE "JOURNAL OF THE ROYAL ARMY MEDICAL CORPS."

SIR,—I read with interest Lieutenant-Colonel T. B. Nicholls article on "Heat Stroke and Allied Conditions" published in the February issue of the Journal for 1939. It has often struck me that in these days of motor and aerial transport the transfer of heat-stroke cases from hospitals in the plains to the hills could be carried out more often with great benefit.

The use of a motor ambulance with some form of cooling device installed should not be difficult especially now that the Royal Indian Army Service Corps have refrigerator vans in use for the transport of chilled meat. Transport by aeroplane might also be rendered practicable if local treatment could be carried out during the journey.

I think these are problems which require consideration, if they are not already solved. In a mechanical age it strikes one that the picture of heat-stroke cases lying in stifling wards should no longer be a feature in hospitals in India.

Cambridge Hospital,
Aldershot.
July 1, 1939.

I am, etc.,
N. CANTLIE,
Lieut.-Colonel, R.A.M.C.

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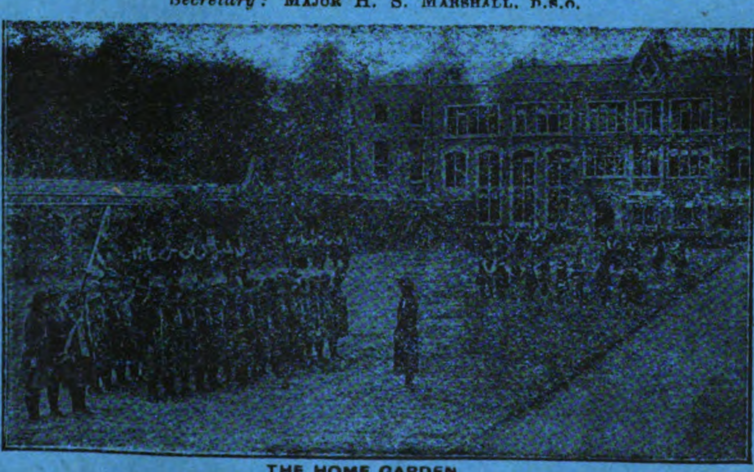

THE HOME GARDEN.

No. 3 September, 1939. Vol. LXXIII.

Journal OF THE Royal Army Medical Corps

ISSUED MONTHLY

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JOHN BALE, SONS & CURNOW, LTD.
83-91, GREAT TITCHFIELD STREET, LONDON, W.1

Price Two Shillings and Sixpence net

VOL. LXXIII. SEPTEMBER, 1939. No. 3

Journal
of the
Royal Army Medical Corps.

Original Communications.

CARBON MONOXIDE POISONING

A REVIEW.

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Royal Army Medical Corps.

(*Continued from p.* 95.)

CHRONIC POISONING.

THIS type of carbon monoxide poisoning is the result of inhalation of small quantities of the gas over long periods, and there can be no doubt that atmospheric percentages of it sufficient to produce chronic poisoning of greater or less degree in individuals exposed to it for any length of time will be found occasionally in garages, repair shops, motor vehicles, and the like.

It is even probable, as stated by Leschke, that many a feeling of annoyance in the office or kitchen and many a nervous disorder is due to an increased irritability from inhalation of carbon monoxide owing to small leakages, or careless handling of gas-stoves.

The symptoms of chronic poisoning are very varied, and are in many cases of a nervous or mental type and may frequently be mistaken for neurasthenia. Headache is the most common, while dizziness is of almost general occurrence. The individual concerned is usually markedly irritable, easily tired and lacking in power of concentration, while he often has a pale yellowish complexion.

Gastro-intestinal disturbances, neuromuscular pains, muscular weakness, drowsiness, faintness, insomnia, may be observed in various patients, while cardiac symptoms are not uncommon, particularly dyspnœa and palpitation. Cough is reported to occur in quite a large proportion of cases.

As regards the headache, Beck [24] in a summary of symptoms referred to by Drinker, emphasizes that it is usually dull in character and located in the frontal region in which area a sense of pressure is often complained of. At times the headache is of a throbbing type. He also impresses upon us the fact that the dizziness accompanying the headache is usually most distressing owing to the disturbance of gait involved in many cases which simulates that of a drunken man.

From a study of the summary referred to it would appear also that general muscular weakness may be expected in a number of patients.

Finally, Beck makes a particular point of the cardio-respiratory manifestations of chronic poisoning and states that he found a slow pulse more frequently than a rapid one. Other authors apparently agree with him in this.

Drinker stresses the extreme variability in the mental and nervous symptoms other than those already mentioned, and tells us that they may vary from disorders of vision, speech and hearing, to vasomotor disturbances, paræsthesias, impotence, bladder troubles, etc.

It should be noted that the pallor which is so commonly found is usually not associated with anæmia, though this condition may occur in certain cases. Drinker considers that the pallor is more often a vasomotor phenomena in some way related to headache or indigestion or both.

Mention should also be made of the extraordinary visual hallucinations that may occur in cases of chronic poisoning with carbon monoxide, and in this connexion readers may be interested in an account given by Wilmer [25] and quoted by Drinker of the experiences of a family who lived for several months in a house with a leaky furnace. They frequently saw figures walking about the halls or in the rooms, so that some of the group became convinced the house was haunted.

Finally, it is perhaps wise to remind readers that the degree of ill-health produced in a number of persons inhaling low and identical concentrations of carbon monoxide for the same period of time is likely to be extremely variable, and that while some individuals will not suffer at all, others will show quite definite symptoms of intoxication.

Individual susceptibility and resistance to the effects of the poison are the factors in the situation which account for this.

Acclimatization slight in degree also occurs and will be operative so long as exposure to small concentrations of the gas continues.

Consequently, individuals more or less constantly exposed to small atmospheric proportions of the gas will after a time require somewhat higher proportions for the development of toxic symptoms. This acclimatization is not permanent and rapidly disappears when exposure ceases.

Diagnosis of Carbon Monoxide Poisoning and the Detection of the Gas.

Although carbon monoxide alone is odourless, it should be remembered that the ordinary coal gas which is a fruitful source of it can be smelt and quickly gives evidence of its presence.

Similarly the average exhaust gas from a car has a distinctive smell of burning oil which gives a definite warning of its presence, and it would seem particularly important from our point of view that drivers of Army vehicles should be on the look-out for this odour and should report its occurrence to the authority concerned with a view to remedial action being taken.

The circumstances, the physical signs, and the symptoms of a case of suspected carbon monoxide poisoning will normally be sufficient to settle the diagnosis. On the other hand, even when exposure to the gas is known to have occurred, to say nothing of when no such definite information is available, physical signs and symptoms may not be adequate to the purpose, and under such conditions it is necessary that we should realize from the practical point of view the essential features of the situation as regards the detection of carbon monoxide in the blood and also in the atmosphere.

Before proceeding to a more detailed consideration of the methods of estimation of carbon monoxide in the blood it is well to remind readers that normal individuals will often show small proportions of the gas in their blood varying from perhaps 1 to 3 per cent saturation of the hæmoglobin, and that tobacco smoking is probably a factor in the situation in a number of cases.

Most important in diagnosis is the immediate taking of a sample of blood after the patient has been removed from the contaminated atmosphere, and its being kept in a sealed vial away from contact with the air until it is dealt with.

When death has occurred also chemical examination of the blood, obtained preferably by cardiac puncture, will determine the cause of death with practical certainty as any gas in the blood when respiration ceases will remain for some time. With regard to this point, Sendroy states that in the available literature on the subject it has been shown that the gas may be demonstrated in the blood by direct chemical and spectroscopic analysis for as long as 210 days after death.

The writer referred to also mentions two possibilities drawn attention to by Ramsey and Eilmann [26] which may prove to be of medico-legal importance, firstly that blood containing carboxyhæmoglobin may be pumped into a corpse, and secondly that a body may absorb after death in the embalming and body fluids demonstrable amounts of carbon monoxide from an atmosphere containing the gas.

As regards the detection of carbon monoxide in blood, much investigatory work has been carried out, but from the point of view of use in the field it would seem that one method only requires mention ; others used from time to time being open to objection on various accounts. It is based on

the fact that a light grey-brown suspension is formed after a few minutes when normal blood diluted with water is treated with a solution of tannic and pyrogallic acids, whereas with blood having carbon monoxide in combination with hæmoglobin a light carmine suspension is formed. In any mixture of normal blood, and blood containing carbon monoxide, the suspension will be a corresponding mixture of the two extremes of colour.

The apparatus includes a set of standards to represent the different colours of varying but known amounts of carbon monoxide in combination with hæmoglobin with which unknown specimens can be matched. According to the *Review of Carbon Monoxide Poisoning*, published in 1930 by the United States Public Health Service, in which this method is described, the percentage saturation of carbon monoxide in the blood can be determined within 5 per cent. Sendroy, on the other hand, does not quite agree with this and in his opinion, if it is possible to take a blood sample at once, a laboratory method should be used. When no doubt as to symptoms and treatment exists the sample may be analysed at leisure as no change will occur in the blood if it is stored in the dark and not in contact with air.

There appears, however, to be no doubt that the pyro-tannic acid method mentioned does afford a rough means of establishing in the field or away from the laboratory the presence of carbon monoxide in the blood.

It should of course not be forgotten that blood containing carbon monoxide in appreciable quantities tends to become cherry red, this colour change becoming more marked with increasing percentages of the gas in the blood.

From a laboratory point of view, the quickest quantitative procedure is the spectroscopic one in which the Hartridge reversion spectroscope is used. Only 0·1 millilitre of blood is required and accuracy is ± 5 per cent. This accuracy may apparently be increased to ± 2 per cent by the photographic determination of the gas using the same spectroscope.

Sendroy points out, however, that the apparatus is costly and requires clear solutions, which are not always obtainable as blood on dilution is occasionally cloudy, and recommends the gasometric method developed by Van Slyke and his associates and modified by himself and Liu. Here the blood gases are extracted *in vacuo* in the Van Slyke-Neill chamber and removed to a special pipette where the oxygen and carbon dioxide are absorbed by alkaline pyrogallol solution. The blood mixture in the chamber is replaced by air-free glycerol-salt-solution. The carbon monoxide and nitrogen are returned to this chamber and the former is measured directly by absorption with cuprous chloride. Normally 1 to 2 millilitres of blood are required. Accuracy is stated to be ± 1·5 per cent, and blood oxygen content may also be estimated so that oxygen lack is revealed whether due to carbon monoxide or not.

In Haldane's method, which is a simple one, the carbon monoxide in blood is estimated by shaking the diluted sample with a solution of ammonia and ascertaining the amount of the gas present by colorimetric comparison

with varying shades of a standard carmine solution. About 0·5 millilitre of the sample is required.

Turning for a moment to the estimation of carbon monoxide in air, it will be realized that this matter is one of very great moment from the preventive point of view, especially in regard to ensuring that ventilating devices are adequate to the need.

Sendroy conveniently divides the methods according to the purposes for which they are required, as follows :—

(1) Qualitative or semi-quantitative which give information as to the presence or absence of the gas with a rough idea as to the amount.

(2) Quantitative or strictly accurate methods for research work and the like.

(3) Continuous and automatic methods for detection analyses, recording, alarm, and ventilation control.

In the first-named group the iodine pentoxide method is probably the most used. Carbon monoxide reacts with a mixture of iodine pentoxide and fuming sulphuric acid in the cold. The reaction is strongly exothermic and is accompanied by a colour change in the solid reagent (Hoolamite, i.e. iodine pentoxide with fuming sulphuric acid and an inert supporting material such as pumice). This colour change corresponds to increasing concentrations of the gas. The minimum detectable concentration of carbon monoxide by this method is according to Sendroy not less than 0·1 per cent. Approximations up to 1 per cent are possible.

The palladium chloride reaction is also employed. Here, proportional to the amount of carbon monoxide, varying shades of colour from grey to black or brown, are produced. Paper or cotton soaked in the chemical solution and then dried is normally used. Apparently 0·03 to 0·05 per cent of the gas in air may be detected by this means.

As regards the second group—the quantitative or strictly accurate methods—the spectroscopic method will be known to many readers. In this the carbon monoxide is first absorbed in blood or in a hæmoglobin solution in which the hæmoglobin has been reduced.

The carboxyhæmoglobin is then estimated by the Hartridge reversion spectroscope already mentioned. The objections to the method stressed by Sendroy are firstly the cost of the apparatus, secondly the measurements in all cases are based on empirical calibrations which in turn must be related to results obtained by some other standard method, and thirdly they are all subjective depending on the analyst's visual judgment. Also, when used for air, large samples are required and the presence of oxygen which also combines with hæmoglobin, is sometimes a complicating factor.

It is undoubtedly the case that certain other methods will give just as accurate results with less expensive apparatus, and of these for small amounts of carbon monoxide in the air the iodine pentoxide procedure is the best. In this the air containing carbon monoxide is passed over dry solid iodine pentoxide at about 150° C. or over a mixture of this chemical with fuming

sulphuric acid at room temperature. Carbon dioxide and iodine are produced and are then absorbed in a suitable medium in each case. Measurement is then carried out usually by titration.

The chemical equation of the reaction is as follows :—

$$5CO + I_2O_5 = 5CO_2 + I_2$$

Sendroy, by using the Van Slyke-Neill gas-analysing apparatus, reports he has been able to determine carbon monoxide in air in concentrations of 0·05 to 0·3 per cent with an average error of ± 2·4 per cent, and states that reduced blood is used to absorb the gas from a suitable volume of the previously de-oxygenated gas sample, after which the analysis is carried out according to the procedure of Sendroy and Liu for blood analysis already mentioned with measurement of the carbon monoxide by direct absorption in cuprous chloride solution.

Haldane's method is also used, and is a comparatively simple one. It embodies the absorption in ammoniated blood solution of carbon monoxide from the sample of air and its estimation in this solution by comparison with standard carmine solutions as already described in connexion with the estimation of the gas in samples of blood.

The method is only suitable for air containing less than 0·2 per cent of carbon monoxide, and should more than this quantity be present the sample is diluted with pure air.

Other methods have also been practised, but those mentioned comprise the most important.

It is of moment, however, to remind readers that for approximate and rapid determination of the carbon monoxide content of an atmosphere a portable and convenient apparatus is obtainable based on the iodine pentoxide method. It can be obtained from Siebe Gorman and is known as the "Burrell carbon monoxide detector." The price is £10.

As regards the third group or methods for the continuous and automatic detection of carbon monoxide for purposes particularly of recording, alarm, and ventilation control, satisfactory apparatus for the purpose is available and can be obtained.

From a military point of view the use of canaries and mice as detectors of the gas is of moment, and they are much employed for this purpose, especially in connexion with mining. These small creatures will become affected in two minutes in an atmosphere containing carbon monoxide, in which it would be thirty minutes before a human being showed symptoms. It is stated in the "Medical History of the War" that mice are not so easily frightened as canaries, are easier to employ as test animals, and if properly trained can be carried in the pocket until wanted. Also they were trained to climb over the hand, in this way inhaling more of the air to be tested and giving a quicker indication of the presence of gas. Apparently small birds and mice do not suffer from after-effects of carbon monoxide, and when placed in good air recover completely in a few minutes.

Treatment of Carbon Monoxide Poisoning.

The treatment of this form of intoxication is governed by certain general principles, and these are summarized by Drinker as follows :—

(1) The removal of carbon monoxide from the blood and restoration of its oxygen-carrying capacity as rapidly as possible.

(2) The assumption that the heart is beginning to dilate and the taking of measures which will favour the restoration of its normal tone and function.

(3) The combating by changes in position of the accumulation of fluid in the bronchi and in the dependent parts of the lungs.

If these principles are faithfully adhered to a maximum measure of success in treatment will be ensured.

As regards effective steps to be taken which embody these principles, the following are those of main importance.

The rapid removal of the patient to the fresh air is essential, and in most severe cases artificial respiration will be necessary. The types of breathing found in such cases have already been referred to (page 90), and the reader will have gleaned that in a majority of patients breathing will be noticeable though often extremely slight in degree. It will rarely have stopped unless the patient is dead. In this connexion Drinker emphasizes the fact that there is a period of twelve minutes only after respiration ceases in which artificial respiration must be started, and that if more than this period of time is allowed to elapse, circulation will undoubtedly fail.

Artificial respiration should be carried out by Schaefer's method, in connexion with which certain points of practical importance are stressed by Drinker, which the author feels should not pass unmentioned.

Firstly, rather than stretching both arms of the patient straight out, it is preferable to use the back of one hand to support the cheek in order to keep the mouth off the ground. X-ray studies have, it is stated, shown that unless the neck is bent far more than is possible by resting it on one hand, no trapping of fluid in the windpipe can possibly occur.

Secondly, most experienced men exert pressures of 100 to 125 pounds at each downward movement, and with an artificial respiration rate of 12 to 15 a minute harm may be done by untrained individuals unless the hands are in the correct position and all the movements carried through smoothly and deliberately. Moreover, some regulation of thoracic pressure to the age and condition of the patient must be made, and special care must be taken with old people and children.

Thirdly, the notion that if an individual is breathing at all, artificial respiration should not be applied, must be deemed as completely erroneous.

Fourthly, the position of the patient is important, and Drinker strongly recommends that the patient should be placed on perhaps a door or table inclined at an angle of 30° with the horizontal and the head at the lowest end.

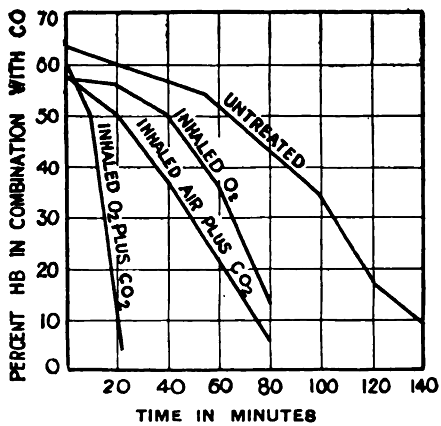
Fifthly, when artificial respiration has to be given in the case of an individual who has recently undergone an abdominal operation, or of a

woman in a more or less advanced stage of pregnancy, Silvester's method should be employed.

Finally, it is well to remember that by Schaefer's method enough air ill be provided to sustain life for as long as eight to twelve hours in the absence of any vestige of normal breathing.

In addition to artificial respiration the administration of oxygen combined with 5 to 7 per cent of carbon dioxide is essential in all severe cases of poisoning, and the fact should not be lost sight of that this measure is also likely to be useful in mild poisoning and to be efficacious in cutting short headache and nausea.

The *raison d'être* of this measure of treatment has already been referred to (page 80), and it suffices to say that the oxygen-carbon dioxide mixture



A comparison of the rates of elimination of carbon monoxide from the blood of gassed dogs when untreated, and when treated with the inhalation of oxygen, with the inhalation of air plus carbon dioxide and with the inhalation of oxygen plus carbon dioxide. (Henderson and Haggard, 1922.)

should be given through an inhaler as soon as possible, and should be administered for at least twenty minutes in mild cases and for three hours or even more if the patient does not recover consciousness. The mask should be simply placed over the mouth and nose and not strapped on, and supervision of it should be kept by an assistant with a view to eliminating the possibility of the mask being filled with vomit and the patient being suffocated.

Before proceeding to consider other aspects of the question of treatment, it may be of interest to many readers to remind them of the comparative rates of elimination of carbon monoxide from the blood in the untreated cases, and in cases t.eated with inhalation of (*a*) air and carbon dioxide, (*b*) oxygen, (*c*) oxygen and carbon dioxide.

The essential features of the situation are best indicated by the above chart, in which the extreme value of oxygen inhalation combined with carbon dioxide is convincingly demonstrated.

In addition to the important measures of treatment just described, the greatest care is necessary to ensure that the patient is kept warm.

Rubbing of the limbs and the use of blankets, hot-water bottles, hot bricks, and the like, will aid in encompassing this.

Complete rest to the patient also is essential if strain on the heart is to be avoided, and later he should be treated as convalescent and given an ample period of recuperation. On no account should victims of carbon monoxide poisoning beginning to recover consciousness be allowed to get up and walk about.

Blood transfusion has been recommended in the past, but Drinker, probably rightly, condemns the practice and points out that the only thing it will accomplish will be an unnecessary addition to the blood volume and a consequent increase in the burden on the heart, as with adequate treatment the carbon monoxide content of the blood will already be low, by the time the transfusion arrangements are made.

There is more to be said for bleeding followed by blood transfusion.

As regards drug treatment, practically no form of drug is likely to be of any material value.

The administration of strychnine, digitalis, pituitary extract, adrenalin, alpha-lobelin, camphorated oil, or other stimulants is not recommended, and Drinker points out it often happens that when one has no effect others are given with definitely detrimental results.

The one drug which Drinker considers may improve the depressed state of the respiratory centre is caffeine, and he considers that it should be given intravenously.

He also thinks that adrenalin in desperate cases only may be tried but in exceedingly small doses owing to the proneness of the asphyxiated heart to fibrillate with this drug, which means certain death.

Drinker also stresses that the prompt application of warmth and rest in the prone or supine position are the most important factors in promoting the circulation.

As regards diet, this should obviously be light and nourishing, and forced or rectal feeding may at times be necessary. A plentiful supply of water should be given to promote activity of the kidneys, and the bowels should be kept open.

Finally, mention should perhaps have been made of the fact that in about one-third of the cases the lungs contain an undue amount of moisture and this point requires consideration especially in regard to changes in position of the patient.

In drawing this section of his article to a close the author would apologize for not giving detailed information on the subject of mechanical devices for the administration of artificial respiration, but would plead in extenuation in the first place lack of space, and in the second the fact that from a military point of view such devices are hardly of practical application at present as far as poisoning by carbon monoxide is concerned.

PREVENTION OF POISONING WITH CARBON MONOXIDE.

The principles of prevention of this form of poisoning are in the first place the avoidance wherever possible of exposure to the gas, in the second good ventilation to ensure that in situations in which carbon monoxide is produced the proportions of it in the atmosphere are kept down to a minimum. and finally, where the practice of adequate ventilation cannot accomplish this and exposure of the individual is essential, the employment of protective equipment.

If, in addition, these principles of prevention are to achieve their maximum effect it will be manifest to all that education of the public is a matter of prime importance, and it is imperative that, whether in civilian or military life, steps should be taken to ensure that all concerned are adequately warned of the dangers of carbon monoxide and are instructed in regard to the important factors in the situation as regards the elimination of its hazards as far as is practicable.

In this connexion, and from the strictly military point of view, it is difficult to avoid the impression that sufficient attention is not being paid to the matter and that more active steps should be taken to bring it to the notice of all officers and other ranks throughout the Army and especially those who are concerned with mechanized units, mining, and other activities in which carbon monoxide poisoning is a definite risk.

Turning now to the avoidance of exposure to the gas, this principle of prevention clearly covers not only the obvious measure of keeping an individual out of a contaminated atmosphere altogether, but also the less obvious one of keeping a given atmosphere completely free of carbon monoxide.

With regard to this point, and of special importance in civil life is the adequacy and efficiency of all gas tubing and appliances used in connexion with the ordinary gas supply, with a view to ensuring that the possibilities of leakage of the gas itself or of its combustion in an insufficiency of air are reduced to the absolute minimum.

This involves some satisfactory system of approval and registration of apparatus to ensure that bad designs are eliminated, and of inspection of gas apparatus in houses especially when first installed, with very particular attention to the measures adopted for the disposal of the fumes of combustion.

Drinker, who deals with this subject in some detail in his book, gives interesting information as to measures of this nature adopted in certain parts of America. He also points out with regard to the reasons for incomplete combustion of gas that these include not only a deficiency of oxygen which may arise from a variety of causes such as unsatisfactory design, improper adjustment, clogging of orifices, etc., but also from the impingement of the flame on cold surfaces, a state of affairs which is likely to occur at times particularly in connexion with gas water-heaters. Hence the urgent necessity for the provision of adequate flues and room ventilation.

Of interest also is Drinker's statement that gas which in the raw state

contains much carbon monoxide does not on that account liberate more of this gas on incomplete combustion than does a gas such as natural gas (chiefly methane and ethane) which in the raw state has none at all. This is due to the fact that carbon monoxide burns more rapidly than hydrocarbons.

We have dealt in outline with the question of keeping atmospheres free of carbon monoxide from the ordinary domestic gas, and it will be realized that measures on similar lines will be essential in regard to carbon monoxide from other sources.

It appears hardly necessary to go into these in detail, and it will suffice to remind readers that, as mentioned previously in this article, adequate flues and ventilation are essential for all stoves, furnaces, and the like, while arrangements must be made in connexion with internal combustion engines run in enclosed or semi-enclosed spaces for the exhaust fumes to be adequately disposed of to the outer air, this applying in principle to motor vehicles as well as stationary engines. Also, just as satisfactory domestic gas apparatus and fittings are essential, so also must those for dealing with the exhaust gases from engines of all descriptions be efficient for the purpose.

In many situations it is clearly impossible to keep a given atmosphere entirely free from carbon monoxide by leading off fumes which contain it to the outer air, and under such circumstances the answer to the problem is efficient ventilation with a view to the maximum dilution of any of the gas present, and the solution of the difficulty is the same whether we are dealing with garages, repair shops, armoured fighting vehicles, mines, and so on.

It is not within the province of this article to deal in detail with this wide subject of ventilation, and it suffices to say that all plans of new garages, repair shops, and the like, to say nothing of those for armoured fighting vehicles, should be very carefully inspected with a view to ensure that the designers concerned have given full attention to this important point.

As far as mining operations are concerned, the urgent need for efficient ventilation cannot be overestimated.

It will be realized also that in semi-enclosed big gun emplacements or turrets some form of mechanical ventilation will often be required, and that the necessary power for this will frequently be available.

In dealing with the problem in " pill boxes " and the like, it is clear that mechanical ventilation is likely to be impracticable, and the greater the amount of natural ventilation the less protected the structure is. It will consequently be necessary in many cases in dealing with the question to combine as efficient ventilation as is possible with limitation of the quantity of carbon monoxide produced by restriction within certain limits of the bursts of firing practised.

As already indicated, it may be necessary at times for personnel to work in atmospheres contaminated with toxic proportions of carbon monoxide. This is particularly liable to occur in connexion with mines

and mine rescue work, and the use of protective apparatus of some sort is obviously imperative. The ordinary respirator will not deal with carbon monoxide and the use of equipment which will deliver oxygen in a closed circuit is required.

During the War the Proto apparatus was chiefly used and was considered suitable and efficient. It is understood to be still the standard equipment. Oxygen is delivered from small cylinders carried on the back to a breathing bag where it mixes with the expired air, the latter being first deprived of its carbon dioxide by passage through a compartment containing caustic soda. Closing of the breathing circuit is of course attained by the use of a face mask with the necessary tubing and valves. For work which did not necessitate more than half an hour in the mine, a smaller apparatus, the Salvus, was used, the principles of this being similar to the larger type of equipment mentioned.

Adequate mine rescue organization during the War was a matter of great importance, and full details are given in the " Medical History of the War, Diseases of the War," Volume II, Chapter XXI, to which readers are referred.

Finally, and in view of their importance and of the fact that they cover so many important points in connexion with the prevention of gas poisoning and accidents in mines, certain general instructions which were published in the official " Memorandum on Gas Poisoning in Mines " are given verbatim as an Appendix to this article.

In conclusion, the author writes to express his gratitude to Colonel D. T. Richardson, M.C., M.B., for the trouble he has taken in reading through this article in its preliminary stages, and for the many valuable suggestions he made, to Lieutenant-Colonel S. Smith, M.B., F.R.C.P., for the assistance he has given in connexion with the section dealing with treatment, and to Major S. Elliott, O.B.E., T.D., for similar help rendered in regard to the section concerned with the detection of the gas.

APPENDIX.

PREVENTION OF GAS POISONING AND ACCIDENTS IN MINES.

General Instructions.

I.—*After a Mine Explosion.*

(1) When a blow occurs, even though this appears to be a long way off, all men working below must come up at once.

(2) The officer in charge must be notified at once, and information sent to the nearest rescue station for the trained rescue men and apparatus. Where possible all the rescue apparatus and material should be carried by fatigue men in order that the rescue men may arrive at the mine perfectly fresh.

(3) Whenever a blow occurs all the trained mine rescue men are to proceed to the nearest rescue station.

(4) The officer in charge is to superintend rescue operations and is responsible that all orders are obeyed. He should see that everything is done to improve the ventilation.

(5) No man is to descend the shaft without rescue apparatus till the mine is reported clear of gas.

(6) A sentry must be posted at once at the shaft-head to carry out that order.

(7) Men who have had no previous training in the use of rescue apparatus are forbidden to use it.

(8) Infantry are prohibited from taking part in rescue operations. Where this order has been disobeyed, the would-be rescuers have frequently been seriously affected and absorbed the attention of the trained rescue party to the prejudice of the men in the mine, and valuable time and lives thus lost.

(9) Rescue men should also work in pairs, never singly unless under very exceptional circumstances.

(10) No naked lights are to be used in the mine till it is clear of gas. Electric lights only are to be used, as the gas in the mine may be present in explosive amount. When men are in a mine when a blow occurs and their lights are extinguished, they should make their way out without relighting these; and where the force of the blow has not been sufficient to put out the candles, they must be immediately extinguished. A sufficient supply of miners' electric lamps should be brought to the mine from the rescue station, as work is more rapidly carried out in a well-lighted shaft and gallery.

(11) The life-line (which is to be used for no other purpose than rescue work) at the shaft-head should be unwound ready for immediate use, and spare lines brought from the rescue station and kept in readiness.

(12) A strong canvas belt with a hook should be kept with the life-ropes at the shaft-head for use where mine stretchers are unavailable or cannot be used.

(13) Mine stretchers should be sent down the mine. No man who has been gassed is to ascend the shaft without being roped. Serious cases are to be brought up on the mine stretcher.

(14) Great care must be taken with all men, however slightly gassed, when they reach the shaft-head, as exposure to cold often leads to loss of consciousness.

(15) Before any apparatus is worn it must be carefully examined by the man who is actually going to wear it, special attention being paid to the valves and gauge. Cases have frequently occurred where men have had to leave rescue work owing to some small defect in the apparatus, which should have been adjusted before descending the mine. A spanner and spare nose clips should always be carried in the pockets. When a number of men are involved in a blow, a relief squad with apparatus ready should be in readiness

to assist at a moment's notice. Whenever a defect is discovered, punctured bag, leaking valve, diminished supply of oxygen, overheating of caustic cartridge owing to exhaustion of caustic soda, etc., the squad should immediately come out of the mine.

(16) Blankets, trench stretchers, hot-water bottles, and *café-au-lait* must be brought from the mine rescue station and kept in readiness.

(17) Oxygen reviving apparatus (Novita) is to be taken into the mine by the rescue men whenever possible. Where there are a number of men poisoned and it is difficult to move them until further assistance arrives, oxygen may be administered; and in desperate cases it should always be given, as it will drive sufficient CO from the blood to permit the removal of the men with safety.

(18) If any difficulty is experienced in getting down the small and medium circular steel shafts while wearing the apparatus, a straight-down emergency ladderway in the hoisting compartment should be at once installed.

(19) In very cold weather it is found that the caustic soda does not absorb CO_2 with sufficient rapidity for the first few minutes the apparatus is worn, with the result that difficulty in breathing is experienced. This difficulty is readily overcome by wearing the apparatus for a few minutes without putting on the nose clip, when the warm breath will quickly raise the soda to the temperature necessary for efficient absorption of CO_2.

(20) Men should be warned that the gas helmet and box respirator issued to the armies for protection against hostile gas (chlorine, etc.) afford no protection against mine gas, as CO is not acted on by the chemicals in the helmet or box.

II.—*Precautions to be Taken where Gas is Known to be Present in the Galleries in Such Small Quantity that Work can be Carried out, and Minor Symptoms of Gas Poisoning, e.g. Headache, etc., only Develop after Prolonged Exposure.*

(1) Canaries or mice must be kept constantly in the mine, and changed every two hours.

(2) Should the canaries or mice show any signs of being affected, all the men must come up at once.

(3) When it is urgently required to carry out work in a gallery where exposure causes headache, etc., to develop in two hours, work should be carried out in relays, the men working ten to fifteen minutes with thirty minutes out.

(4) Two Proto and two Novita sets, ready for instant use, should be kept at a place convenient to the shaft head; and two rescue men engaged in such surface work as will permit them to be in instant readiness should their services be required.

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"S.W.1."

By Lieutenant-Colonel G. W. Will, O.B.E.
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The transport of sick and wounded by air has recently been the subject of much attention and has more than proved its value. It promises to develop into a normal method of evacuation on the North-West Frontier while it is being developed extensively in countries as far apart as Australia and Scandinavia.

Fired with air-minded enthusiasm medical boards have suggested transport by air in the case of patients being transferred from India to England. I was very much in favour of this until I recently travelled from Gwalior to Southampton by air. I am now convinced that, in its present form, transport by air between these two countries is suitable for only a very limited class of patient. I may, I hope, be forgiven for describing what is now becoming a commonplace experience in giving a brief account of a journey to England.

Except at Southampton, where there is a specially designed experimental landing stage, communication between the land and the flying boat is by motor launch. A good deal of agility is required to get from the shore to the launch and from the launch to the boat. Once one is aboard the flying boat the comfort is all that could be desired. They are wonderful machines. In flight they are steady, remarkably free from noise, and meals are served with much less fuss and in greater comfort than in a Pullman car on an English railway. There is a small library, the latest illustrated papers are carried, lavatory accommodation is good, while the catering is surprising in variety and quality. There is a smoking room and also a small promenade deck where a form of quoits may be played. The comfort of the adjustable chairs is now almost proverbial. The seats and backs can be removed to form a very efficient life-saving jacket.

Crossing India stops are made at Calcutta, Allahabad, Gwalior, Raj Samand, and Karachi. The west-bound liners normally stop for the night at Gwalior. It was here that I boarded the air liner "Camilla" at six of the clock on a dull, dreary, damp monsoon morning. It was not quite the setting for a first flight, and I must confess that I viewed the proceedings with a grave lack of equanimity. Within a few minutes of taking off this had completely disappeared and from then on one had complete confidence in the machine. It was still more comforting to learn that the pilot—Captain Alcockson—had flown the Atlantic eight times and had done the experimental flight to New Zealand. Indian regulations do not allow passengers to remain in aircraft while refuelling is in progress, so we all

went ashore at Raj Samand, where we were given remarkably hot and strong tea. The shore staffs evidently consider that all air travellers are "he-men" as the strength of this tea was exceeded only by that later provided on the yacht at Mirabella, where it was nothing less than phenomenal. Before reaching Karachi the steward suggested a little refreshment —a kindly thought, as Imperial Airways stock a palatable brand of light ale.

After Karachi the first stop is at a desolate spot called Jiwani, some twenty miles from Gwadar in Baluchistan. There is nothing to be seen beyond a sheltered stretch of water where boats can come down in almost any weather. There had been some difficulty about the water supply, but this must have proved satisfactory as the Indian Government have now decided to spend two and a half lacs of rupees on building an up-to-date airport. Here we met an eastward-bound boat refuelling. The night's halt is made at Dabai in Oman, and passengers are driven at high speed across some miles of desert to the fortified rest-house at Sharjah, where is the land aerodrome. This is most comfortable, with an oak-panelled (imitation) lounge and dining room; a roof garden; plenty of ice; electric light and fans, and every convenience except a "pull the plug." This will doubtless come before very long. Here you find English papers only two or three days old. We dined in the open under the stars—it was cool and pleasant.

The next morning we were called at 04.30 hours, left the rest-house at 05.10, and the boat left the water punctually at 06.00 just as the sun rose over the desert. This proved a most interesting day. The first stop was made at Bahrein, where there operates an American oil company employing some two hundred and fifty Europeans. They are all housed in air-conditioned houses. All the buildings are air-conditioned—offices, recreation rooms, canteens, hospital, and school. So successful is this that children are allowed, and recently the number of teachers has been increased from one to two. I am told that a very high standard of physical and mental fitness is maintained. Here we met the eastward-bound boat which had left Basra that morning and Corfu the previous morning. Between Bahrein and Basra we had breakfast and then, wrapped in rugs, slept peacefully until, awakened by a sharp pain in the ears, found that we were circling over Basra. It does not look very attractive from the air, but the airport is the last word in comfort and efficiency—indeed it is luxurious. We soon found ourselves sitting down to cocktails in an air-conditioned bar, and thereafter to an excellent lunch in a beautifully appointed dining room. This was a little hurried as certain engine adjustments had not taken so long as had been anticipated.

It was here that the personalities of the passengers began to show themselves. One was an English solicitor who had been out to Sydney in consultation and was the first passenger to make the return journey; the next was an Australian company promotor leaving his homeland for the first time; then a Scot from Bengal with a predilection for the most terrific cheeroots ever known to man; and finally two Army officers. The number

of passengers was limited by the fact that we were carrying the first " all up " mail from Australia and New Zealand—some three and a half tons of it. As this was the inaugural flight for this service it was known as " S.W.1 "—Sydney Westwards 1.

From Basra to Lake Habbaniyeh we flew at somewhere about 12,000 feet—our Captain did not like the heat! Up there it was cold enough for a couple of rugs, it was hazy, the cocktails had been generous and the lunch good. One's impressions of Iraq were just about as hazy as its remote history, and gazing down at dimly discerned desert one did not blame Father Abraham for leaving Ur of the Chaldees and seeking the goal for which we were also making.

At Habbaniyeh refuelling and passport and customs formalities were carried out as rapidly as possible and we were off in pursuit of the sun towards Palestine. As the afternoon wore away the Captain brought us down to a lower level and we were able to identify Rutbah Wells, the pipeline pumping stations, and to have a good view of the singularly inhospitable terrain over which we were travelling. It looked very hard ground on which to make a forced landing in a flying boat. Approaching Galilee there are signs that cultivation is slowly stretching out into the desert from which it was driven so long ago.

At eventide we came to Lake Galilee and landed quietly on the water at Tiberias just at sunset. This is a most attractive-looking place with green trees and gardens. The Arabs had shot it up a day or two before. After a quick refuelling we were off again, climbing in widening circles to gain height before crossing the Galilean hills towards the sea.

Lights were switched on and our green and chromium cabin looked comfortable and homelike. The tables were laid and dinner was served by the steward as immaculate in his white coat as when he had been my cabin steward on the " Ranpura " some three years before. There was a cocktail to start with, then hors d'œuvres, hot tomato soup, cold fish, hot roast chicken with green peas and new potatoes, ice cream, a savoury, and finally coffee and a liqueur. All this while flying nearly two hundred miles an hour at a height of some 10,000 feet over the Holy Land. We had left Old Father Abraham a long way behind.

Port Said was passed at a height of about 3,000 feet, and was a most delightful sight. So also was Alexandria, where we arrived about 10 o'clock. We made a perfect night landing between lines of flares and were comfortably installed in our hotel before eleven. This was a long day and a tiring one, and not just quite what a sick man should have to endure. The total distance was 1,781 miles.

The next day we left about 07.00 hours, called at Mirabella Bay in Crete; Peffko for Athens; Brindisi; and finally Lake Bracchiano for Rome. It was a perfect day, hardly a cloud in the sky all day. At Rome we stayed at the Hotel de Russie in no small luxury. The bar has a ceiling exactly like that in the Turkish Bath in the Fort at Agra. It is most curious. The

Romans brew an excellent brand of beer and dinner was accompanied by an excellent Chianti—when in Rome drink what the Romans drink. After dinner some of the party went sightseeing, but beyond verifying the fact that there are many cats in the Coliseum by night, did not seem to have met with much success.

We were called at 02.30 hours and were off the water at the crack of dawn. The reason for this early start was revealed at Marseilles where we spent some six or seven hours while certain engine adjustments were made. Then, for the last time there came the now familiar " All passengers please take their seats for the take-off," followed by the First Officer's " Engines ready to start, sir," and away we went. We left the Aeroport de Marignane at 15.30 hours and flew non-stop to Southampton, where we landed at 19.25 hours. Before leaving Marseilles the Captain had given his time of arrival as 19.30 hours. Dinner was served on a special train to Waterloo and there was much more noise and vibration than at any time in the air. Ten days before two of the passengers had dined in Sydney. My own dinner programme had been : Saturday, Bombay ; Sunday, Gwalior ; Monday, Sharjah ; Tuesday, in flight over Palestine ; Wednesday, Rome ; and Thursday, in the special Pullman between Southampton and Waterloo. The homeward mail steamer which had left Bombay the same day had not got very far up the Red Sea.

Now this is an extremely rapid, interesting, and comfortable method of travelling if one is fit and well, but even then it is tiring. It is not a suitable method to use in sending sick people from India to England. That it may become so is probable, indeed certain, but at present a sick man is better in a steamer. The vibration is very slight, but at the end of three days most of us were complaining of slight " heads." The two through passengers from Sydney said that they had had quite enough. The steadiness of the boat is remarkable, and no one could possibly have been sick ; perhaps we were fortunate in the weather conditions, which were perfect except between Gwalior and Raj Samand. Even in the typical monsoon conditions there encountered I was unable to notice any " bumping."

After this experience I would never suggest sending either heart or lung cases by air. Neither would I send surgical cases who required dressings nor cases with any difficulty in locomotion. It is an ideal way to send home the case of early malignant disease where the diagnosis is in doubt and where an early diagnosis and treatment may be all-important. In the near future when bunks are installed (the fittings are already there), and the journey from Karachi to Southampton is completed in two days, it may be possible to send other types of patient, but at present its usefulness is limited.

It is, however, the method *par excellence* of going on leave, and next year it will be possible to have almost a week in London on a ten-days' leave out of Karachi. It might be as well to precede this by winning either an Irish sweepstake or the Calcutta one.

Mileage flown from Gwalior:—

Raj Samand, India	268
Karachi	702
Jiwani, Baluchistan	1,017
Dabai, Oman	1,442
Bahrein, off Arabia	1,742
Basra, Iraq	2,086
Habbaniyeh	2,402
Tiberias, Palestine	2,871
Alexandria, Egypt	3,223
Peffko for Athens, Greece	3,810
Brindisi, Italy	4,179
Bracchiano for Rome	4,493
Marseilles, France	4,863
Southampton, England	5,484

Flying time approximately 36 hours.

REPORT ON THE THIRD INTERNATIONAL CONGRESS ON TROPICAL MEDICINE AND MALARIA, AMSTERDAM, 1938.

By Lieutenant-Colonel E. F. W. MACKENZIE, O.B.E., M.C.,
Royal Army Medical Corps.

The Congress opened on Saturday, September 24, with a speech of welcome by the Chairman of the Netherlands Society for Tropical Medicine. Professor Dr. E. P. Snijders. This was followed by speeches by the General President of the Congress, Professor Dr. G. Grijns, and the President of the Malaria Congress, Professor Dr. N. H. Swellengrebel. The latter, in the course of an excellent speech, gave a timely warning against the common error of generalizing from local experience in malaria prevention, and quoted as an example the widespread application and the not infrequent failure of species sanitation which arose as a result of its successful application in Malaya. He emphasized the fact that every district has its local problems, and that it may well be of advantage to be ignorant of what one's neighbour does, since not to be so is to court failure, unless a careful study of local conditions and bionomics of the vector is first made.

Deficiency Diseases.

In his introductory paper Major-General Sir Robert McCarrison paid tribute to the Dutch physicians who first demonstrated that disease can arise as a result of the absence from a diet of certain essential constitutents of foods. He considered food to be of paramount importance in determining man's general physical condition and resistance to disease, and emphasized the importance of the introduction of biological investigation in revealing the functions of the various accessory food factors. These investigations, combined with chemical analysis, are gradually revealing what these substances are, and why a diet composed of natural foods in the correct proportion is a deciding factor in the maintenance of health.

Deficiency disease may arise, not only as a result of inadequate supply, but from inability to utilize essential substances. Increased expenditure or excessive loss arising from pathological or physiological conditions may also be concerned with the onset and continuation of deficiency disease. as also may relative deficiency of one essential to another. Diminished absorption and utilization as a result of pathological conditions of the gastro-intestinal tract are also of importance in this respect. He considered the functions of the accessory food factors to be not so much "anti," in the sense of "anti-beriberi," etc., as that of activators of a large number of physiological functions. Attention was drawn to the importance of impoverishment of the soil as a factor related to the nutrient qualities of foodstuffs,

and the paper closed with the contention that a large proportion of human ailments result from malnutrition, either alone or in combination with microbic or toxic causative factors.

This contention was strongly supported in a paper by Médicin General A. Thiroux and Professor G. Moriquand, who gave numerous instances of the association between infective conditions and vitamin deficiency. Among these were the susceptibility of certain peoples who are deficient in vitamin A to bronchopneumonic diseases, attributed to fragility of the pulmonary epithelium, and the occurrence of rickets in sunny countries where this condition is unusual, almost exclusively amongst hereditary syphilitics, probably on account of their inability to synthesize vitamin D.

Professor P. J. du Toit, of South Africa, described an investigation into the relationship between osteodystrophic diseases in domestic animals and calcium and phosphorous in their diets. This investigation was carried out in a country of abundant sunshine, and it was justifiably considered that vitamin D was adequate. The investigation originated from the observation that cattle acquired perverted tastes such as the eating of bones. The addition to their diet of phosphorous alone not only prevented this condition, but led also to general improvement in their growth and milk production. Phosphorous deficiency in foodstuffs was found to be widespread in South Africa. The natural supply was most conveniently supplemented by the addition to the diet of bone meal which also supplied calcium. A calcium-phosphorous ratio of 1·2 : 1·0 was found to be the best proportion, and phosphorous retention was found to be profoundly influenced by the calcium intake. High calcium intake adversely affected phosphorous utilization. Rickets was found to be produced by a calcium-rich but phosphorous-deficient diet, and any increase in calcium while the phosphorous remained low exaggerated the condition.

In cattle osteodystrophia fibrosa developed on a low calcium intake; rickets developed on a low phosphorous intake. This was invariably the case in horses, goats and sheep.

To summarize, the author considered that rickets (osteomalacia) resulted from a diet deficient in phosphorous, while calcium deficiency gave rise to osteodystrophia fibrosa. Since these conditions arose in the presence of abundant vitamin D it may be assumed that conditions ascribed to avitaminosis D may in reality be attributable to deficiency in the diet.

Professor Dr. B. Sjollema dealt with the desirability of studies of mineral deficiencies in the tropics and emphasized the fact that the native populations of large tracts live almost entirely on the vegetable products of their own locality. He considered that when some general reason might be held to account for a lowered physical condition the supply of minerals, such as iron, iodine, phosphorous, calcium, copper and natrium, in the locality should be investigated in addition to other possible causes. He drew attention to the intimate relationship between minerals, vitamins and hormones. Deficiency of minerals might be due to the presence of an insufficient

quantity in the soil, or to inability of the vegetation to absorb them as a result of improper cultivation or infection.

In a general discussion all speakers emphasized the intangible lowering of the standard of health in the absence of definite morbid conditions, which may result from hypovitaminosis or from mineral deficiency. This is particularly liable to be the case when a population lives almost entirely upon the products of its own locality.

Professor Dr. J. C. P. Jansen discussed the chemistry of aneurin (vitamin B_1). During the past two years this substance has been synthesized, and it is now produced on a commercial scale. During the above period the price has fallen from 100 guilders to 6 guilders per gramme, and a considerable further drop in price seems possible. This would make it available for administration on a large scale.

A new quantitative test for aneurin was demonstrated. The introduction of this test has demonstrated avitaminosis B_1 in Europe in certain cases, especially in pregnancy.

It was considered that the synthetic aneurin will be more effectual in combating beri-beri on a large scale than the vitamin-rich vegetable preparations. It was suggested that in countries where a salt monopoly exists the most suitable method of administration might prove to be by vitaminizing the salt.

During the course of this paper attention was drawn to the process of parboiling rice which prevails in parts of Burma and in other countries. This process diffuses the vitamin B into the grain and subsequent polishing removes only a part of it.

Professor Alfred C. Reed, University of California, issued a word of warning regarding the desirability of ascertaining whether prevention of sub-clinical conditions is socially desirable before undertaking mass protection. Limits in the food supply of a locality bring about a natural limitation in population and massive interference may upset the balance of nature.

Certain measures of general application for securing adequate dietary, such as governmental control of food supplies, education and demonstration, were discussed, and the conclusion was arrived at that these general measures are applicable in some degree everywhere. Nevertheless, success will depend upon the thoroughness of their application, and primarily upon the economic status of the area concerned, which may be seriously disturbed by measures leading to uncontrolled increase of population.

A paper by Dr. W. R. Aykroyd, read by Sir Robert McCarrison, described a series of experiments on animals and human beings designed to ascertain the most serious of the dietary deficiencies in certain areas of India compared with the standards advanced by the Technical Commission on Nutrition of the League of Nations. In these areas rice is the staple article of diet, and is supplemented by only small quantities of pulses, vegetables and fruit; meat, eggs and milk are almost entirely lacking from the diet. The beneficial

effect of a supplement of dried skimmed milk was noted, whereas pulses, meat and eggs were less valuable. In spite of its deficiency in vitamin A, 22 to 48 grammes of dried milk daily caused striking improvement in children. Less marked improvement was brought about by the administration of yeast, and the addition of protein in the form of casein was of only slight benefit.

It was considered that the great improvement effected by so small a quantity of reconstituted dried skimmed milk was due to a great extent to its high calcium content.

Dr. Tom D. Spies, of the University of Cincinnati, described the responses of 600 pellagrins to treatment with nicotinic acid, following upon the observations of the curative effect of this substance in canine black tongue. After the administration of nicotinic acid in sufficient doses to a pellagrin in relapse the alimentary tract symptoms disappear in twenty-four hours. This was admirably illustrated by coloured lantern slides showing a case with advanced lesions of the tongue and lips. The results following the administration of nicotinic acid recalled the dramatic effect of "606" on secondary syphilitic lesion of the mouth and throat when this drug was first introduced. Lesions of the mucous membranes heal within twenty-four hours, mental symptoms are rapidly relieved, appetite and digestive system are restored, and the patient recovers a sense of well-being. The dermatitis is usually cleared up within fourteen days. These clinical tests were held to be adequately controlled. Patients were maintained on a selected diet for some time without improvement. Nicotinic acid was then given and improvement resulted. The drug was then withdrawn and the patients were allowed to relapse. When the administration of the drug was resumed, improvement began again and continued. A further point noted as a result of treatment was the disappearance from the urine of increased amounts of ether soluble substances, giving the colour of porphyrin in HCl.

The dose of nicotinic acid was stated to be 1 gramme daily, in divided doses. The opinion was expressed that nicotinic acid is a substance essential to the life of human beings.

(I ascertained from Dr. Spies, in the course of private conversation, that the dose is administered, usually by the mouth, in 10 doses of 0·05 to 0·1 gramme at hourly intervals. Also that the necessary dose varies greatly in different cases, some requiring ten times as much as others. The average dose was 0·5 gramme daily, but in some cases it was necessary to raise this to 1·5 grammes. It appeared that no claim is made as yet that nicotinic acid effects a cure. It is claimed that recurrences can be prevented at least through one "pellagra season," by a somewhat heroic daily dose. Dr. Spies also made it clear that nicotinic acid, while giving cerebral relief, does not abate the peripheral nerve symptoms which require vitamin B_1 complex.)

Professor C. D. de Langen, of Utrecht, outlined the historic investigations into the vitamin B complex, and the sub-division of this into 6 or more components. He drew attention to the flood of proprietary literature on

the advantages of vitamin B concentrates, which threatens to engulf us, and regretted that even in medical literature many morbid conditions have been attributed to avitaminosis B on altogether insufficient grounds. A study of normal medical publications indicates that there are at least twenty-five distinct diseases which are cured by the B_1 complex alone. A host of other morbid conditions are said to be alleviated thereby. Among the diseases attributed to B_1 deficiency are all types of polyneuritis and single-neuritis ischias and other neuralgias, as well as beriberi-like polyneuritis. Attention was drawn to the fact that there is no multiple sclerosis in the Dutch East Indies, and it was questioned whether observers were not carried away by their enthusiasm in supposing that all these conditions may be associated with each other or with B deficiency. Vitamin B_2 deficiency was discussed as a possible cause of pellagra, sprue and some anæmias, and the conclusions drawn from animal experiments were considered.

The question was discussed whether the body may not excrete excess of vitamins because they do harm, and it was held that there is no proof that vitamin saturation is helpful to the body. This most interesting paper closed with a warning that vitamins should not be considered a panacea for all ills.

In the discussion following this section Professor de Langen described his experiences with ten cases of pellagra in Holland. These, unlike the American cases, exhibited no excess of porphyrin bodies in the urine. The first case was not treated, and died. The remaining nine cases were treated with nicotinic acid and recovered.

(Professor de Langen kindly gave me the following information in the course of private conversation. He employed doses of nicotinic acid of from 50 to 150 mgm., given by the mouth thrice daily, starting with the smaller dose and increasing gradually if this was indicated by the daily progress of the case. He found that a daily consumption in excess of 450 mgm. was liable to cause complaint on the part of the patients. He said that, while nicotinic acid had proved capable of controlling the disease over the "pellagra season," no observations had yet been made over extended periods.)

Yellow Fever.

Dr. Fred L. Soper, of the Rockefeller Foundation, discussed the results of extensive protection against yellow fever by the use of modified virus 17 D. He considered that the elimination of the animal source or the vector is not possible in the case of the jungle yellow fever of South America. Vaccination, therefore, remains the only means of protection. The use of the active virus, attenuated, but without immune serum, was commenced in June, 1937. In September, 1937, routine vaccination was commenced and by the end of that year 36,000 inoculations had been completed. The number for 1938 will exceed one million, half that number having been vaccinated by July, 1938. At present the quantity injected represents 350 to 800 m.l.d.s for mice, but

this may be reduced in future. The dried virus remains active for long periods but is susceptible to heat and sun and must be stored on ice.

The reaction is not sufficiently severe to exert any deterrent influence on the population. Children and pregnant women are vaccinated without ill effect. There has been no contra-indication (see later under Discussion). Experiments have shown that there is insufficient virus in the peripheral blood after vaccination to infect *Aëdes ægypti*, and the attenuated virus does not again become virulent if *A. ægypti* is artificially inoculated with it.

Protection begins not later than one week after vaccination, although protective bodies may not be demonstrable in the blood at that time. The duration of post-vaccination immunity remains to be determined. It is considered that vaccination establishes a powerful line of defence against long-distance transference of the virus by aeroplane.

Owing to the circumstances in which vaccination is being performed, extensive follow-up of cases is not possible, but a good general idea has been obtained from the incidence in special groups vaccinated, e.g. labour on selected estates. Owing to the liability of the virus to be destroyed, the necessity was emphasized for the performance of a viability control test on mice with the last portion of each batch of virus used. Post-vaccination tests indicate a high degree of immunity.

Dr. G. M. Findlay described the results of 5,000 immunizations carried out by means of attenuated virus 17 D. He had experienced slight fever in 5 to 10 per cent of cases after vaccination. Ninety-two cases of jaundice were attributable to the vaccination. These were indistinguishable from catarrhal jaundice and were liable to occur months after vaccination. He considered that this complication was due to pooled human serum, and that it should not arise in the future. In discussing the immunity conferred, Dr. Findlay drew attention to the fact that no case of yellow fever had occurred since the introduction of vaccination amongst the large number of Europeans proceeding to West Africa.

The relative degree of protection conferred by neurotropic virus and by pantropic attenuated by tissue culture was discussed. It was considered that the former conferred a considerable degree of immunity for eighteen months to two years, and that in some cases this might extend to five years. Pantropic virus showed no inferiority in this respect.

A point of considerable interest was that yellow fever, which had previously been thought not to exist east of the White Nile, has now been proved to be prevalent between the White and the Blue Nile.

In the discussion following these papers Dr. Soper agreed that he also had seen cases of hepatitis arising sometimes months after vaccination. He agreed that this condition could not be attributed to the virus itself. As regards the vector, Dr. Soper drew attention to the fact that people living close to, but outside, the jungle in Brazil did not normally contract the disease except after a visit to the jungle, when they frequently did so. He described how two species of *Aëdes* other than *ægypti* which

had been captured in the jungle this year had been infected with the virus and had infected susceptible monkeys with the disease.

Not all the South American monkeys are susceptible, but Dr. Soper appeared to be of the opinion that susceptible animals formed the reservoir of infection.

Professor E. P. Snijders described the vaccination of 34 persons, 19 by combined immune serum and neurotropic vaccine, and 15 by pantropic vaccine only. Attempts to demonstrate the presence of the virus in the blood up to seventy-two hours after inoculation were made in 12 cases of the first group and 5 of the second. All failed to do so. In 18 persons tested from ten days to ten months after vaccination immunity tests revealed various degrees of immunity. Five cases of jaundice and severe hepatitis occurred in from two to four months, and one case of slight encephalitis shortly after vaccination.

By this stage in the proceedings, war had appeared to be imminent. Many delegates and authors of papers had departed. The atmosphere of strain which had been increasing throughout the week had become one of acute tension, quite incompatible with serious study. As a result of this state of affairs considerable last-minute rearrangements of the agenda were constantly necessary.

It thus became almost impossible to arrange a personal programme which would enable a consecutive account of the proceedings in any one section to be constructed.

The following part of the report therefore represents no more than an attempt to outline the more important discussions which it was possible to attend.

(*To be continued.*)

Dr. JAMES BARRY: INSPECTOR-GENERAL OF THE ARMY MEDICAL DEPARTMENT.

BY COLONEL N. J. C. RUTHERFORD, D.S.O.

(*Continued from page* 120).

So James Barry settled into a secure post where he was entirely his own master as to his private life and free from direct observation. In the pose of a bachelor officer he would not be expected to entertain at his house, but would be freely received by all the hospitable Colonial families of the Peninsula as well as the immediate Government House circle. The young Staff Surgeon also established a reputation as a skilled physician, especially in midwifery and women's diseases. Here, obviously, came in the special training when on half-pay in London and the natural aptitude of a woman to become skilled in the diseases peculiar to her own sex.

So wide became the reputation of young Barry that soon the civilian families at the Cape were calling him in in place of the local doctors, and Barry was soon established as a private practitioner as well as Staff Surgeon; there being no official reason why the doctors of the garrison should not occupy their spare time in private practice, though, as a rule, Army doctors refrained from doing so because they considered it was not fair to the local doctors to " cut in " and take their patients, and also because most medical men who joined the Army did so to escape the hard life of the ordinary practitioner, and preferred an easier existence with perhaps less money, but leisure for games and sports and opportunities to travel about and see the world.

However that may be, it is probable that Barry did not earn the affection of the local doctors, and was attacked as a meddling, purse-snatching fellow, pushing his way into the life of the Colony when he was living there as a Government servant and not a resident.

But Barry's position at Government House protected him from anything more than some grumbling and spiteful gossip. From all accounts, Barry had excellent social manners, talked well, could be light and gay in conversation with the fair sex, and was not averse to paying marked attention to some of the pretty girls for whom the Cape has always been famous; and even getting into trouble for his flirtatious ways.

Also in her dress she was somewhat flamboyant, and in these days would be described as a good publicity agent. When riding out to pay professional visits to patients her progress and appearance were somewhat startling. Always in uniform with a high gold-laced collar, belted and spurred, glittering in the bright Cape sunlight, one can see her riding sedately down to the town or making a longer journey to Wynberg to call upon her friends the Cloetes at Alphen. Riding up the long avenue to the dignified White House with the pillared stoep, handing over her horse to a native servant, and entering the tall cool rooms with polished floors and the stately old Dutch furniture.

Dining with the family and listening to the mellow tones of the old slave bell calling in the workers from the fields. Strolling out into the hushed evening silence of the calm Cape evenings, her tongue loosened by pontac and van der hum, as almost the fact of her true sex was sunk now in her virile life and the easy acceptance by all of Assistant Surgeon Barry, the clever physician, the Staff Officer, the favourite of the Governor, admired and complimented. Why, quite a dashing blade! Though small and weakly looking, her feet tiny in her polished boots, the thin hands and tapering fingers of the skilled accoucheur, the face pale as always, even under African skies, but the clear pale skin of the red-haired, the large dark eyes and the small mouth, the easy flow of small talk, of London, the opera, the names of highly placed ones tripping off her tongue, no wonder some charming Miss Van Breda, or Du Plessis, or Van Ryn, or an English Miss of the Government House circle, fell in love with the dashing Dr. Barry. It all culminated in a quick quarrel, hot words, and a meeting at Alphen between Barry and Captain Cloete, the A.D.C. to the Governor. The trouble was concerning a lady that Cloete admired and whom he discovered in Barry's company under somewhat embarrassing circumstances. Barry had a way of suddenly becoming intimate in her manner to any young woman she had taken a fancy for, and in fact became as feminine as young women of her period could be in their sudden passions for some girl friend. This attitude was likely to be misunderstood by the ladies themselves and by the young men involved. Barry was so firmly established now in her male character that she did not hesitate for a moment to take up the challenge thrown at her head by Cloete. The meeting was a hurried one, and the small party of young gentlemen strolled away from the house towards the wide stoep facing the vineyards spreading up the slopes of Table Mountain. A fellow officer of Barry's, also a surgeon, acted as his second. Cloete had an officer of the Garrison to act for him. Preliminaries arranged and pistols chosen, the duel took place on the ground pointed out to me by a member of the Cloete family in 1932. Cloete escaped, but Barry was hit through the thigh, a flesh wound, nothing serious, but painful. Barry wore a long cloak, and as soon as shots had been exchanged and honour satisfied, had immediately resumed the voluminous garment. Her second, a Surgeon Foss, saw Barry stagger at the discharge of the pistols and rushed forward to see what had happened; had Barry been wounded? Recovering her cloak Barry wrapped herself in the long folds and denied having received any injury. All she demanded was a rapid return to her own house in the Gardens. Foss soon had her Cape cart and pair of smart horses produced, and having made her peace with young Cloete, Barry set off on the eight miles drive home. Pale as always, she was doubly pale now. Foss again demanded :—

"Are you wounded?"

"No, no, nothing, get me home soon, that is all I ask."

A nip or two of good Cape brandy kept Barry going until her house was reached and she could climb down from the Cape cart, which she did stiffly.

" Come now, Barry, I must have this cloak off and examine you. I'm sure Cloete winged you somewhere."

" No, I tell you again," snapped Barry, " I am all right, and get me to my room and then leave me."

Helping her up the steps to the stoep the cloak fell away and Foss saw Barry's breeches were dark with blood in the front of the right thigh.

" You *are* wounded, Barry—I must dress the wound. Get into your bedroom. Ishmael (Barry's Malay servant boy) and I will undress you and soon get you right."

Barry set her teeth and painfully limped to the door of her bedroom. As she entered she called over her shoulder :—

" I don't *want* you or Ishmael. Now for God's sake go and leave me in peace."

Astounded at this strange treatment Foss refused to go without some assurance that Barry was not bleeding to death behind the closed door. Sounds of movement convinced him the victim was still alive, and after a time Barry spoke to him. Thanking him for helping her home, she assured Foss the only damage was a superficial wound in the flesh of the thigh, that it was now dressed and comfortable, and would be healed in a few days.

" I ask you particularly," continued Barry in a weak voice, " not to mention the fact that I have received a slight wound to anyone, and not to mention the duel to anyone. Cloete also wishes the whole matter hushed up and will himself keep silence."

With some reluctance Foss promised and left the house. From that day Barry kept out of Foss's way and avoided any intercourse, obviously evading attempts at friendship or inquiries about the wound.

In a few days Barry had reappeared at her duties and was going about as usual. If Foss happened to be of the same company Barry made a point of ignoring him, and even failed to recognize him when they met. Incensed at this strange behaviour Foss adopted the same attitude and avoided Barry.

More and more Barry kept to the Government House set and her private practice among the civilian population, to whom she was now very well known and admired for the social and professional position she had reached. Having the ear of Lord Charles Somerset, Barry was able to add some Colonial administrative medical appointments to her military duties, and undoubtedly must have been in a much better financial position than her *confrères* in the Medical Service, and in addition there was always the background of money and position at home, vague and uncertain though the evidence may have been to consolidate the fact.

Barry's sympathetic manner, especially towards those of her own sex, got her into difficulties on many occasions. The extraordinary understanding spirit of the dashing young military doctor made many of the Cape beauties sigh for more than a touch of the long slender fingers on a fluttering pulse or the proximity of the head of wavy red hair to a fair white bosom as

the cold ring of the long wooden stethoscope rested on the tender skin and Dr. Barry murmured " Say ninety-nine " almost as if he was confessing his love. The still starlit evenings under the old oak trees at Alphen as the guests of the hospitable Cloete family sat on the broad stoep after supper were conducive to women and love. The trouble between young Cloete and Barry was but a trifling one in those days, and having exchanged shots in honourable fashion they were again on friendly terms. Frequently at these popular Sunday evening suppers other members of the Garrison would be present, and it was always notable that Staff Surgeon Barry stood stiffly on rank and position if at any time some young ensign or lieutenant presumed to be too familiar or off-hand with her, and never hesitated to assume a strictly regimental air should a reproof be necessary. This attitude in addition to the invariably stiff rigidity of uniform she adopted, made her none too popular with the younger officers, but Barry cared little for that. So long as she remained *persona grata* at Government House her position was unassailable. But even so at times her quick temper and inability to accept orders which incommoded her in any way must have frequently led to trouble from which even the Governor could not save her. The Senior Medical Officer, Surgeon-Major McNab, had to write out that important document, the Officers' Annual Confidential Report, in which the opinion of the local Commander is recorded for the use of the War Office. Nobody could prevent McNab from saying what he thought of Assistant Surgeon Barry who, technically speaking, was serving under his orders. It was the custom of the Service that should the Commanding Officer say anything of an adverse or derogatory nature the report must be communicated personally to the officer concerned. An excellent way of placing the senior officer in the position of reading aloud in privacy to the junior officer the unpleasant points in his character and professional capacity commented upon with a view to blocking his future in the Service. So one day Surgeon Barry was bidden to attend at the same gloomy office at Woodstock where he had reported on his arrival at the Cape. It was also necessary that the officer being reported upon should be medically examined and signed " Fit for active service " by a medical officer. Strictly speaking, to do the examination fully, the officer would necessarily be stripped and examined as when he applied for a commission. But the yearly examination had become stale by repetition, and most officers found that the doctor rattled through a bunch of healthy young officers pretty quickly when they presented themselves for their annual inspection. So Barry would not have much trouble in avoiding a searching physical examination each year, especially as she herself was a doctor. It would have been simple to throw the form down before some medical officer acquaintance and say: " Fill up the medical certificate for me. I'm as fit as possible," and the thing was done. But the matter of having to appear before the Senior Medical Officer meant something more serious, and in some trepidation Barry knocked and entered McNab's office. Established now as a social success and a successful staff surgeon, the last thing Barry expected was any adverse

criticism on her work and duties. But she had not considered how her successes might have inspired jealousy in the minds of others not so well placed as herself, and also a feeling that it was time " To take that fellow Barry down a peg or two." Consequently she was inflamed and indignant when the dry McNab curtly read to her extracts from the Confidential Report which stated that " Assistant Surgeon Barry is somewhat unfortunate in his manner, lacking in tact and impatient of control. Otherwise this officer has carried out his duties in a satisfactory manner."

Now here we have a report calculated to damn the outlook of any young man, the cold disapproval of the character combined with the lukewarm, almost grudging appreciation in the wording " Satisfactory."

McNab was palpably uneasy under the hostile glare in Barry's dark eyes as the slim figure stood to attention on the other side of the table. Finishing his peroration McNab passed the report across the table.

" Initial and date this report, please."

But Barry did not move.

" Before doing so, Sir, I demand a period of leave of absence to England to put my case before the War Office."

Astounded at this defiant attitude, McNab threw himself back in his chair.

" Leave of absence to England ? Because of my remarks in your Confidential ? What nonsense, Mr. Barry. An officer must serve at least seven years in this station before he becomes eligible for leave, and then only if his services can be spared. You have not yet served sufficient years and I should certainly not recommend your application for leave. Initial this report and let us hear no more about leave."

But Barry was adamant.

" Should you not forward my application for leave I shall leave the Cape by the next available packet-boat and proceed to England at my own expense."

This open defiance brought McNab out of his chair. Standing bristling behind the table he shouted, " If you do, Sir, you will be posted as a deserter and court martialled on arrival in England."

" That, Sir, remains to be seen. I may remind you that I have certain influences in London which will cancel any adverse reports from even the Senior Medical Officer at the Cape."

Saluting smartly the Staff Surgeon stamped away on his high heels with tinkling spurs. Straight to the Governor goes Barry and demands audience.

Lord Charles had a soft spot for his wayward but entertaining and skilful physician.

" Well, Barry, what's the trouble this time ? No more duelling, I hope ? I heard all about your little escapade at Alphen, and if Cloete had not begged me to ignore the whole matter, you would have been on your way home under arrest."

" I am going home by the first packet and came here to acquaint you of the fact."

"Going home! How do you mean? On leave? Or have you been replaced and ordered home by the War Office? At any rate, I should have been informed of this; you must have my permission before such a change can be made. Under whose instructions are you leaving the Cape?"

"I am leaving the Cape, Lord Charles, because I have decided that it is time I had a new station, and also because I could no longer serve in the same place as that ignorant, common fellow McNab who calls himself the Senior Medical Officer."

"Now, look here, Barry," said Lord Charles, "You have had a row with McNab and you are doing this mad act in a passion. Why, good Heavens, this act will ruin your career, you will be discharged from the Army as soon as you set foot in England. Pray consider the whole affair before you act precipitatedly. What has been the trouble with Surgeon-Major McNab?"

"The fellow had the impudence to give *me*, Barry, a bad Confidential Report in which he called me 'tactless and insubordinate'."

"Well, upon my life, I think McNab was not far out. You *are* bad tempered, you *are* insubordinate, and you are in fact a damned difficult fellow to deal with."

To hear Lord Charles agree with McNab was more than Barry could stand. He whirled out of Government House in a flaming temper. Extraordinary as it may appear, Barry simply defied all authority and embarked himself for the long voyage via St. Helena for England.

What happened at the War Office is not known, but instead of being court martialled Barry was offered an appointment in Jamaica. Never did she want to serve in England, and soon the late Staff Surgeon at the Cape became the Regimental Medical Officer of the 3rd West India Regiment based in Jamaica and serving at British Guiana and Sierra Leone on the West Coast of Africa. As Surgeon to the Regiment Barry would become one of themselves, wear the uniform, and follow the 3rd West to the changes of station. The West Coast capital, Freetown, and Georgetown in Guiana, were neither of them health resorts. Both were renowned at that time for yellow fever and ague. The cause of these endemic diseases was unknown, both being said to be caused by swampy ground and the low mists that rise from the waterlogged lowlands. True enough, as the mosquitoes came from these swampy lands, and proximity meant fever.

How long Barry served with the 3rd West India Regt. is not recorded, but she certainly appears in Georgetown as a "Dr. FitzJames" in a book called "A Modern Sphinx," written by Major E. Rogers, Staff Officer of Pensioners, and published in 1881. It is easy to recognize the description and mannerism of the Barry of the Cape, but now she is older, and getting senior in rank. But what happened between her abrupt departure from the Cape and her appearance at Georgetown? It is quite possible Barry may have returned to the Cape, but it is more likely she was transferred to St. Helena as part of the Cape garrison.

(*To be continued.*)

MECHANIZED FIELD AMBULANCE TRAINING: GIBRALTAR

By Major W. L. SPENCER COX, *M.C.*
Royal Army Medical Corps.

No originality is claimed for the following notes which are published for general interest, while it is hoped that the illustrations may be of assistance to officers not familiar with the methods of constructing shelters.

Instructions were received from the D.D.M.S., Gibraltar Command, that training should include: The packing of equipment by lorry loads with a view to rapid movement; the erection and lay-out of an advanced dressing station both in the open and under cover; the general tactical handling of a company of a mechanized field ambulance.

Personnel.

The personnel of a company of a mechanized field ambulance, less stretcher bearers and batmen, was fully trained and formed a cadre, who, in turn, gave instruction to the remainder of No. 28 Company, R.A.M.C.

All construction, layout, etc., was carried out by these thirteen men, who were selected according to their respective ranks and trades in proportion to war establishments, each of whom wore a brassard stating precisely his correct designation.

Transport.

Three 30-cwt. six-wheeler lorries were provided, the fourth "cooker lorry" was not available. The modified equipment carried, however, allowed that of the cooks, less water in tins, to be carried in an administrative lorry.

Equipment.

Medical equipment, less certain non-essentials, was drawn to scale laid down in A.F.I. 1248–4.

Ordnance equipment, less certain items not at the time available, was drawn according to A.F.G. 1098 series.

Certain remarks on the equipment are made later.

Training.

It is not proposed, in this short article, to give the full details of the training carried out, but merely to state the general principles, and to give an explanation of the illustrations.

In brief, then, the work included :—

(1) Sorting equipment into correct lorry loads according to weight and requirement. Practice in rapid packing, unpacking and movement.

(2) The erection and layout of a temporary shelter with full equipment to provide the following sections: (*a*) Reception—clerical; (*b*) M.O.—adjustment of splints—A.T.S. (for those not immunized)—urgent minor surgery; (*c*) treatment of shock—rechauffage—hot drinks—hot-water bottles, etc.; (*d*) septic wounds—burns—gas cases after decontamination; (*e*) areas for cases awaiting treatment and awaiting evacuation; (*f*) cooking area (N.B.—All meals were cooked in the training area); (*g*) sanitary area;

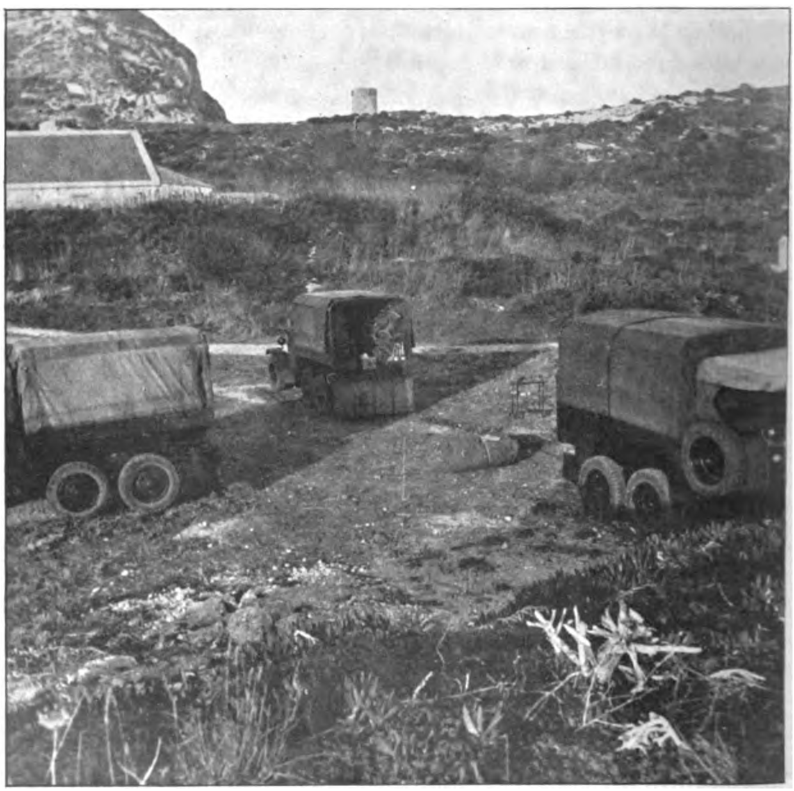
(*h*) gas cleansing area; (*i*) ambulance park—stretcher and blanket dumps. etc.; (*j*) accommodation for M.O. and staff.

(3) Rapid striking of the temporary shelter—packing of lorries and movement to another site.

(4) The layout of an A.D.S. in an underground site. This place was very similar to a dug-out system which might be encountered on active service. and the accommodation, though small, was suitable for the purpose. The carry down was most difficult and provided excellent training for bearers.

B

C



A

FIG. 1.—The lorries are in position, tailboards down, still loaded. The canvas is shown, rolled up, behind lorry A.

For obvious reasons the place was impossible to photograph, but the layout is shown in diagrammatic form.

(5) Demonstrations, covering all the work done, to the remainder of No. 28 Company, R.A.M.C., and to the officers of the fortress.

CONSTRUCTION OF THE SHELTER.

The method used was as follows:—

Lorries A, B and C were placed as shown in fig. 1. The canvas was then firmly attached to the superstructure of lorries A and B. Lorry B then drove slowly forward until the canvas was pulled tight. In the same

way attachment was made to Lorry C, which again moved forward till the canvas was sufficiently taut. (It was found that this second manœuvre could be done by man-power alone if necessary.)

Lorry A is always a fixed point.

C

A

B

Fig. 2.—The canvas is being attached simultaneously to lorries A, B and C.

C

A

Fig. 3.—The correct tension has been obtained and the small covers are being laced to a corner for additional weather protection.

General.

Many small items not provided in the equipment had to be "made": these included ropes and lashings, stout pegs for anchoring the canvas, and old posts or poles to support the two free corners of the canvas, but it is safe to say that if they could be procured under peace conditions they would be still easier to obtain when on active service.

Conditions in Gibraltar also had to be studied; sudden hurricane gusts

Fig. 4.—The shelter is shown erected on another site.

of wind were liable to dislodge both canvas and men, and at times it was wondered if the superstructure of the lorries would stand the strain, while iron pegs driven into the ground with the base of an "axe felling" were liable to assume a "semicircular" outline if the ground was not carefully chosen.

These points, however, were of local interest only.

Conclusion.

The medical equipment provided was entirely satisfactory, the torches, button, Mark I, were particularly valuable below ground.

The ordnance equipment showed certain omissions to which attention is directed :—

(1) Two pairs of collapsible trestles are authorized ; at least three pairs should be provided. It is necessary, as a minimum, to have support for a stretcher at : The reception section, the M.O.'s surgery, and the rechauffage

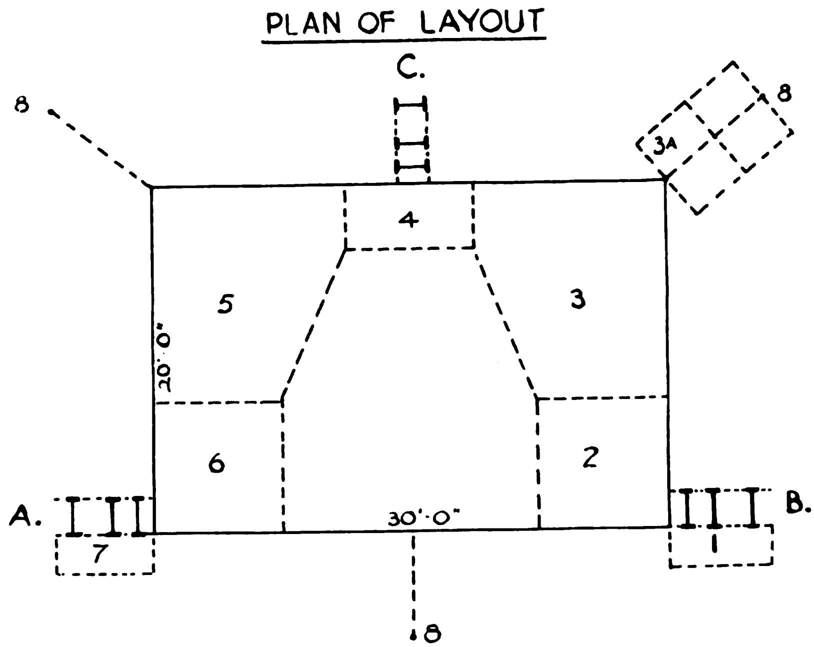


FIG. 5.—(Not drawn to scale.) A, B and C are 30-cwt. 6-wheeler lorries in their positions.

(1) Dumps for stretchers, ground sheets, etc ; in bad weather these are placed beneath the lorry. (2) Reception, clerical section ; the inside of the lorry is also used. (3) M.O.'s Section (3A). A tent R.D. can be very conveniently attached at this point. The pole supports the canvas at the corner. All the M.O.'s equipment is laid out inside the tent and cases awaiting treatment remain in Area 3. (4) Treatment of shock—rechauffage, etc. The stretcher supported on trestles, with blankets, hot water bottles, and oil stove beneath, is placed inside lorry C. The remainder of the equipment is placed outside. The blanket dump is beneath the lorry. (5) Area for cases awaiting evacuation. (6) Septic Section : One stretcher is placed inside the lorry. Basins, primus stove and equipment are placed on boxes, panniers, etc., outside. (7) Picks, shovels, axes, constructional equipment, etc. (8) Improvised weather lines. Stout cord from the posts at the corners to a very strong peg.

N.B.—Cooking, sanitary and gas cleansing areas were at a distance from the shelter.

section. Any boxes, panniers, etc., used for this purpose reduces the number available for laying out instruments, basins, etc.

(2) Hand towels : none appears to be provided ; at least one dozen are required.

(3) Rot-proof covers, 10 by 6 feet : Six are authorized, presumably to be laced together to form a shelter. Those supplied, however, were not provided with eyelets and were therefore quite useless. In practice, a cover 30 by 20 feet was obtained and found to be extremely satisfactory. It is

suggested that this large cover should be included in the scale of equipment either in lieu of or in excess of the small covers.

(4) Cord and lashings : None are supplied for a company of a mechanized field ambulance. At least 250 feet should be provided for each company. A cord similar to that supplied for the weather lines of a tent, R.D., would be perfectly satisfactory.

Training.

Concentrated training over a short period of time by a small company necessitates extremely hard work and willing co-operation by the troops;

PLAN OF LAYOUT UNDERGROUND.

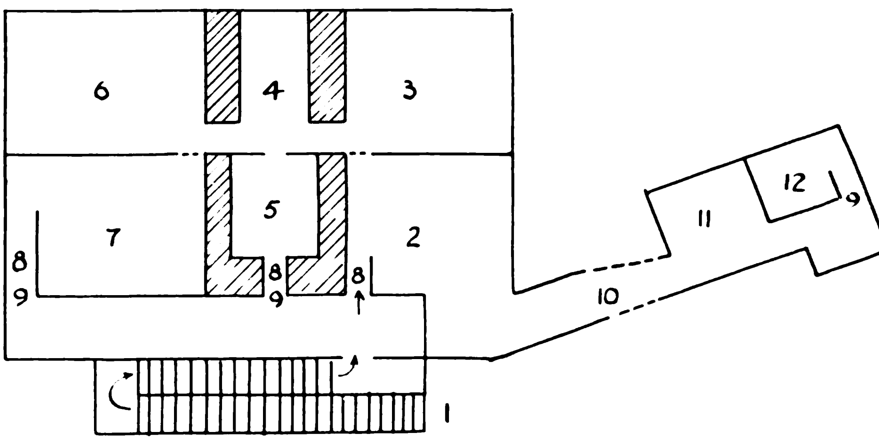


Fig. 6.—(1) Entrance on ground level; very steep flight of steps leading to dug-out entrance. (2) Reception, clerical. (3) M.O. (4) Storeroom. (5) Treatment of shock—rechauffage. Two stretchers on trestles were placed here. (6) Ward for stretcher cases awaiting evacuation. (7) Ward for sitting cases awaiting evacuation. (8) Gas locks. (9) A loaded stretcher could not pass these corners. (10) A long passage in which five stretchers could be placed in a row and still leave room for a loaded stretcher to pass. (11) Septic section. (12) Waiting room for sitting cases.

N.B.—Cooking, sanitary and gas cleansing areas were, of course, above ground.

it is a pleasure, therefore, to record the excellent work put in by the training cadre of No. 28 Company, R.A.M.C. in general, and the organizing ability of Staff Serjeant A. J. Lawlor, R.A.M.C., and the tireless energy of Corporal H. Blackburn, R.A.M.C., in particular.

Acknowledgment.

I am indebted to Colonel M. J. Williamson, M.C., D.D.M.S., Gibraltar Command, and Lieutenant-Colonel C. J. Blaikie, R.A.M.C., Officer Commanding, Military Hospital, Gibraltar, for permission to forward this note for publication.

Editorial.

REPORT OF THE LISTER INSTITUTE.

THE Report for the year 1939 contains many interesting investigations covering a very wide field. Last year we described briefly many of the researches dealing with strictly medical and sanitary problems and further information about these is given in the present report.

Dr. G. H. Eagles has continued his studies of a possible virus factor in the ætiology of rheumatic infections. Attempts to demonstrate the infective power of the virus-like particles obtained by high-speed centrifugation from exudates and pathological tissues in acute rheumatic fever, acute chorea and acute rheumatoid arthritis have not been successful. In certain instances monkeys showed suggestive cardiac lesions, but these were not the same as those encountered in true rheumatic disease in man. In conjunction with Dr. Bradley, Dr. Eagles has shown that the sera of patients suffering from rheumatic fever and rheumatoid arthritis agglutinate the particles whereas the sera of normal persons do not. But no constant relation of agglutination to clinical phases has been found.

Horner, Swift and Brown, of the Rockefeller Institute, have recently announced the isolation of a pleuropneumonia-like organism from rheumatic fever exudates. This may be the long-sought ætiological agent of acute rheumatism. Should this organism be recovered in the studies now being carried out by Dr. Eagles and others, steps will be taken to see if the virus bodies which are agglutinated by the sera from acute rheumatism and rheumatoid arthritis patients are really the filtrable elements of a pleuropneumonia-like organism, or possibly break-down products antigenically related to such organism.

Dr. Felix and Miss Pitt have investigated methods of titrating antityphoid serum. Provided it is known that the Vi-antibody in the sera does not belong to the variety characterized by the peculiar "functional deficiency" described by Felix and Bhatnagar in 1938, the Vi-agglutinin titre as well as the "O" agglutinin titre can be accepted as the final measure of the therapeutic activities of the two antibodies. The routine titration of sera taken in the course of preparation of therapeutic antityphoid sera consists therefore of agglutination tests alone. For purposes of official control the mouse-protection test and the neutralization test in the mouse are indispensable.

The investigation of Vi-agglutination in the detection of chronic typhoid carriers has been completed by Dr. Felix. The test is now being tried in the routine examination for carriers and cultures of Vi strains of *Bact. typhosum* suitable for the test are being asked for by workers all over the

world. Since a standard serum is an indispensable agent for the exact estimation of Vi-agglutinin the cultures are being sent out together with a sample of a "Provisional standard serum" for Vi-agglutination. This serum has been standardized by comparison with the "Dried Provisional standard antityphoid serum" which is reserved for work in connexion with therapeutic antityphoid serum.

The desirability of carrying out vaccination on a population exposed to typhoid infection has been questioned on the ground that undesirable reactions may intervene and possibly be followed by frank disease in persons harbouring the organisms. Such persons may be incubating the disease—in which case it is said vaccination may accelerate the onset of symptoms—or they may be temporary carriers until vaccination converts their state into one of frank infection.

In an attempt to find an answer to this question Dr. Schütze has experimented with the mouse as the subject and *Salmonella typhi-murium* as the infecting agent. As the result of a long series of tests he considers that vaccination started after infection does not damage the animal's normal resistance, but in a considerable number of cases actually enhances it.

Dr. Salaman has continued his work on the antigenic structure of vaccine virus. Sera of rabbits which had received formalized vaccine elementary bodies all contained agglutinin in fairly high titre; virus neutralizing power was variable but always present; precipitin was absent. Sera of rabbits which had received heated vaccine elementary bodies contained agglutinins in low titre. Virus neutralizing power was low or absent, and precipitin was absent. Resistance to infection by active virus was very variable, high in some rabbits, absent in others. In general the immune response of these non-infective inocula differed from that of rabbits immunized with active virus chiefly by reason of its irregularity and the absence of precipitin production.

In co-operation with Dr. R. G. Henderson, London County Council, and other medical officers in that service, Dr. D. McLean (Elstree) has tested the experimental immunization by the intradermal route of groups of nurses and children with elementary body suspensions of vaccinia virus. The resulting immunity of those inoculated has been tested by re-vaccination by scarification with Government lymph after an interval of not less than six weeks. Although the nurses received an intracutaneous injection of a suspension of virus that was active in the rabbit-skin at a dilution of 10^{-5} it was found that a small proportion were not immune to subsequent revaccination with lymph. Groups of children who had not been previously vaccinated were immunized with suspensions potent at dilutions of 10^{-3} and 10^{-4}; local reactions were mild but definite, and a small proportion of the children developed vesicles at the site of inoculation. The resulting immunity was disappointing, and there is some indication that the development of a firm immunity to further inoculation of the virus may depend on

the development of typical vaccinal vesicles at the primary vaccination. When applied by scarification the suspension of elementary bodies produces typical vaccinal vesicles with general constitutional reactions that are indistinguishable from those produced by vaccine lymph.

Dr. Amies and Mr. Carr have studied the nature of the filtrable virus agents of the Rous I and other fowl sarcomata. They report that it has now become possible to obtain adequate amounts of these agents in a relatively pure form—in suspensions containing 1,000,000 tumour-producing doses per cubic centimetre. Serological experiments with these concentrated suspensions have yielded yet more evidence that the agent is closely related antigenetically to some constituent of normal fowl cells. It has been established that the serum of a rabbit hyper-immunized with normal fowl protein will neutralize the tumour agent *in vitro* and that these inhibiting properties can be removed by absorption with a concentrated suspension of the tumour agent. In the fowl the agent behaves as a foreign protein because its presence in the malignant tissue and elsewhere elicits the formation of neutralizing antibodies and agglutinins. It is believed that a full understanding of this phenomenon will constitute a big advance in the knowledge of the virus-induced tumours.

Dr. Schütze has completed his work on plague vaccines. It has always been assumed that in the preparation of Haffkine's vaccines (heat-killed broth cultures), a highly virulent strain of *B. pestis* is essential. Schütze compared the respective merits of virulent and avirulent, smooth and rough variants in the manufacture of such vaccines, and found they were all equally potent preparations. In the rat when the test dose was a large and toxic one, prophylaxis was found to depend to a considerable degree on the envelope antigen contained in the vaccine which should therefore be made from cultures grown at 37° C. In the mouse where the dose was small and invasive, envelope antigen did not exert so marked an effect.

Dr. Schütze has also examined the therapeutic effect on plague infection of the new chemical substances which have proved so successful in the treatment of a variety of diseases. He chose M & B 693, 2-sulphanilyl-aminopyridine, Soluseptasine and diamine - diphenylsulphone - glucoside. Experiments were carried out on both the rat and the mouse and demonstrated a considerable effect on the part of all three compounds, but M & B 693 proved most efficacious against plague in both series of animals. Soluseptasine protected rats and not mice, and the sulphone compound protected mice but not rats.

Dr. V. Korenchevsky and his assistants have continued an investigation of different aspects of sex hormones, using the rat as the experimental animal.

As regards effects on senility, the most active male sex hormone, testosterone propionate, can produce in senile rats supernormal development of the sex organs, but it does not cause any improvement in the senile appearance of these animals. Taking into consideration that the senile rats had normal sex organs, and that these organs and sexual function may be preserved in otherwise senile men, the absence of "rejuvenating" effect of the sex hormones is not surprising. The over-stimulation of the secondary sex organs in senile rats by testosterone propionate cannot be regarded as a rejuvenating effect, since without general improvement of the general condition and other features of senility this artificial sex stimulation is biologically unnatural and in human patients is medically undesirable. Moreover, the administration of testosterone propionate was found to depress the development of the sex glands of senile rats, thus checking the secretion of the natural sex hormones by the testes.

The development of secondary sex organs may be accelerated or depressed by some of the male hormones according to the dose injected. Prolonged injection of weak male hormones produces a "reverse" action, viz. depression of the development of the testes and secondary sex organs. Tumours, probably of cancerous nature, were found in the hypophyses of two of the injected senile rats, and it is not inconceivable that their occurrence may have been connected with the injections.

It is stated that injections of œstradiol dipropionate are followed by development in the uterus of metaplastic changes in the epithelium which are the first stage of a precancerous condition. This develops more frequently when androsterone, *trans*-dehydroandrosterone and testosterone dipropionate are injected simultaneously with the œstrogens. On the other hand, progesterone and (when injected in special ratio to œstradiol) testosterone propionate can prevent these precancerous changes.

The problems of vitamin-A standardization have occupied the attention of the sub-committee of which Miss Hume is secretary. The recent isolation of relatively pure preparations of vitamin A and of its esters has raised the desirability of retaining pro-vitamin A, β-carotene, as the International vitamin A standard. Vitamin A itself, the alcohol, is, however, very unstable; but its esters have greater stability and certain of these are being used for experiment on a large scale in which the material will be employed to determine the value of the conversion factor, the figure employed in converting the results of spectro-photometric estimation to International units (expressing biological potency). It is felt that a trustworthy estimation of the conversion factor, about which there has been considerable controversy, carried out on a pure preparation of vitamin A, would determine whether the spectro-photometric method of estimation is permissible.

As regards vitamin B_1 the International Conference on vitamin standardization decided that the sample of pure vitamin B_1 (aneurin) hydrochloride, which had been investigated by the sub-committee, should in future be

adopted as the International vitamin B_1 standard and that the International B_1 unit be defined as the potency of 3·0 μg. of the pure material.

Dr. S. S. Zilva and Dr. A. E. Kellie have been working for some time on the vitamin-C requirements of man. They have now finished an investigation on the minimum daily dose required to maintain an adult saturated in respect of vitamin C. Equilibrium of excretion was established on doses of 100, 50, and 30 milligrammes, and the minimum saturation figure was found to be in the neighbourhood of the last figure. Previous investigations on animals suggest that a daily dose of about half the saturation figure is sufficient to meet the theoretical requirements of man. The ascorbic acid content of the blood was determined during "saturation" and "unsaturation" at different intervals after the administration of the vitamin in various doses. The comparison of these figures with those of the urinary excretion suggests that there is no constant renal threshold for ascorbic acid, but that there is a competition for the ascorbic acid of the blood by the absorptive capacity of the tissues and the excreting function of the kidney. Blood levels determined at random do not, therefore, indicate the degree of saturation of a subject.

Clinical and other Notes.

A CASE OF DISLOCATION OF THE 12TH DORSAL VERTEBRA.

By Major K. FLETCHER-BARRETT,
Royal Army Medical Corps.

Dislocation of a vertebra as distinct from a fracture-dislocation is a comparatively rare condition. In the case described below, as far as I could detect both by X-ray and naked-eye appearances, there was no fracture present; this contention would appear to be supported by the failure of repeated manipulations to restore the normal position of the vertebræ. The accident happened whilst the patient was sitting underneath a limber wagon making some adjustment to the attachment of the axle. In this position his spine would be flexed, rotated to one side, and laterally flexed, which would account for the inter-articular processes sliding upon one another and so becoming dislocated. I have endeavoured to condense the notes as far as possible, which are as follows:—

Gunner F. was admitted to hospital on March 14, 1938. He was complaining of partial loss of power and numbness in both lower limbs; also of pain, numbness and tenderness over the lower dorsal region of the thorax.

Previous History.—Whilst sitting underneath a supported limber wagon which he was repairing, the support gave way. The wagon fell on his back causing him to be doubled up.

Examination.—No deformity was seen. Palpation over the cervical and dorsal regions was so painful that clinical examination was very difficult and no satisfactory conclusion could be arrived at. No deformity could be detected. There was loss of power in the lower limbs but full sensation was present. The upper limbs and trunk were normal. Immediately he had recovered from shock, he was X-rayed; the report was "no bony injury." The case was considered to be a concussion of the cord with possible œdema or hæmorrhage into its substance. He was put to bed on a fracture mattress.

By March 16 the pain was much less, numbness was still present; there had been slight improvement in power of the ilio-psoas and rectoris femoris groups of muscles.

On March 18 he developed retention of urine followed by incontinence. Owing to the slowness in recovery a further X-ray was taken. This revealed a dislocation of the 12th dorsal vertebra backwards (*see* fig. 1).

On March 21 an attempt at reduction was made by extending the patient between the operating table and a higher support; a plaster was applied. X-ray on March 22 showed that the angulation had been reduced, but the posterior displacement of the vertebra was still present. On March 24 a further attempt at reduction was made—under spinal anæsthesia the

patient was slung up from a Balkan beam and a plaster cast applied. X-ray showed no change. Another attempt at reduction was made on March 26 and a plaster cast applied. During the night the patient passed urine naturally for the first time since March 18.

On March 27 X-ray showed no change; catheterization was again

FIG. 1.

necessary. Some urinary infection together with incontinence of fæces had developed. Movements of the legs were very feeble.

I decided to attempt an open reduction. As there was no suitable means of suspension available, the Royal Engineers made a hoist to my design. This was constructed of strips of girder steel bolted together, with a pulley wheel in the short arm at the top, and capable of being passed over the

operating table. A rough diagram of this is shown in fig. 2, and the hoist in position over the operating table in fig. 3.

Operation.—On April 1 under gas, oxygen and ether intratracheal

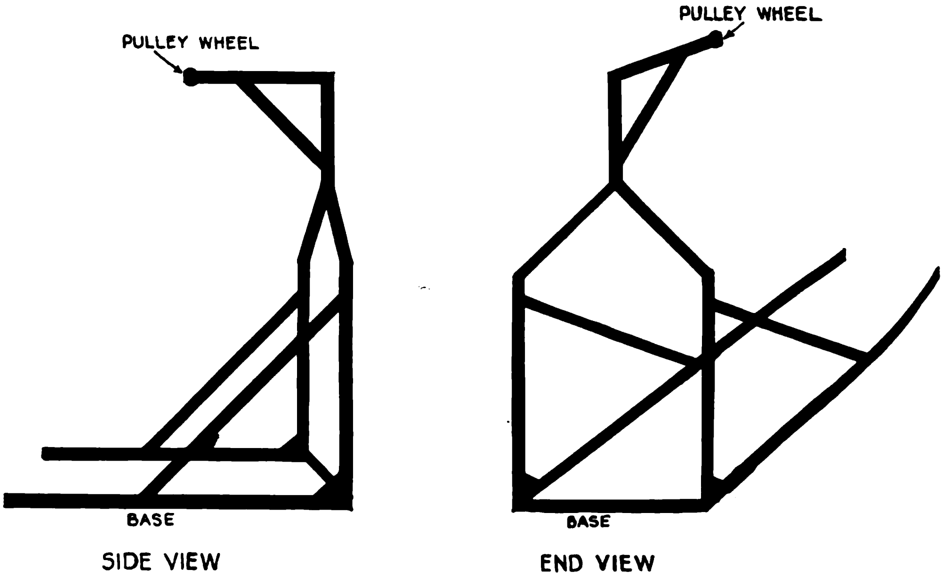


Fig. 2.

anæsthesia, a mid-line incision was made exposing the vertebræ. The spinous process of the 12th dorsal vertebra was removed ; both superior articular processes of the vertebra were seen to lie posterior to those of the

Fig. 3.

Fig. 4.

11th dorsal vertebra. As far as I could detect, no fracture was present. I removed the right superior articular process. The patient was hung up by the feet over the pulley wheel in the hoist ; by grasping the spinous process of the 1st lumbar vertebra and considerable wriggling, the dislocation

was reduced. The wound was closed and a plaster case with a window in the back was applied, the patient being kept fully extended throughout this manœuvre and until the plaster had set (*see* fig. 4).

X-ray on April 3 showed that reduction of the dislocation was complete and perfect (*see* figs. 1 and 5 where marked with X). On April 4 slight

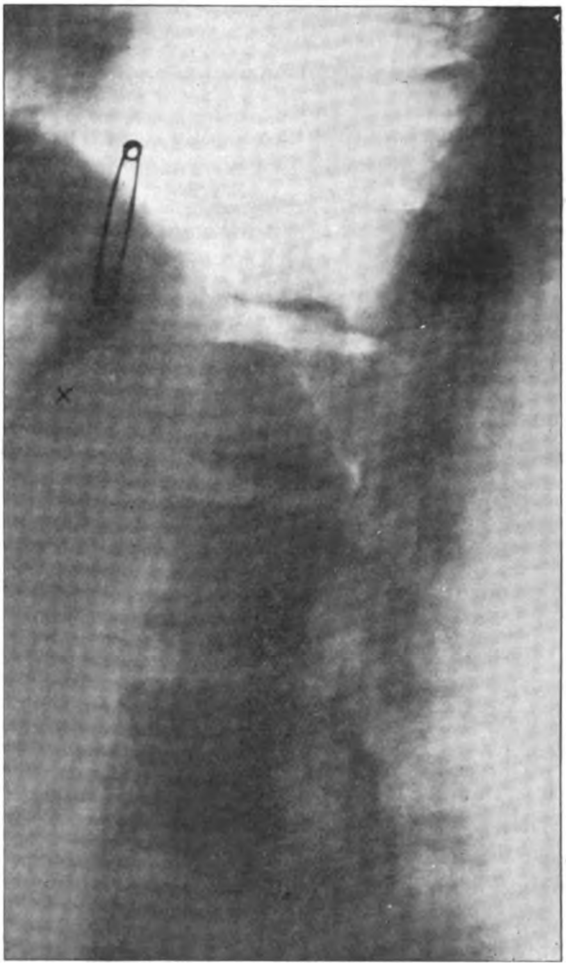


FIG. 5.

temperature was present. The patient passed 50 ounces of urine normally. Examination showed sensation present down to the toes, knee-jerks, extensor toe response, ankle-jerks and clonus were absent.

By April 8 the temperature had settled, there was slight movement of adductors of the left thigh but still less of the right. He had passed urine naturally daily up to 43 ounces per diem, but had incontinence of urine and fæces occasionally during the night.

By April 13 there was definite movement of the extensors and adductors of the left thigh ; but practically none on the right side. Pus in the urine had decreased under treatment. There was a plaster sore over the left anterior superior spine of the ilium. A week later his condition showed gradual improvement.

On April 30 when again seen by me, there had been a great improvement in his general condition and the plaster sore was healing well. There was movement present in both thighs and great toes. Urinary infection was still present with occasional incontinence. He had regained control of his bowels.

He continued to improve so that he was allowed up in a chair on June 7. This improvement was maintained until he was allowed to walk.

When last seen by me in mid-October, 1938, prior to my leaving India, although spastic, he was able to walk with the aid of sticks, and had complete control of both bladder and rectum with no urinary sepsis.

It gives me pleasure to acknowledge gratefully the co-operation of the Royal Engineers (M.E.S.), Rawalpindi. The hoist was constructed to my design by them, very rapidly and at very short notice ; it proved most satisfactory.

I have to thank Lieutenant-Colonel G. A. Blake, Commanding British Military Hospital, Murree, for permission to send this case for publication, also Captain A. Miller, I.M.S., for several extremely difficult anæsthesias.

A CASE OF HYDROPHOBIA.

By Major W. S. EVANS,
Royal Army Medical Corps.

Driver M., aged 23, of the Royal Corps of Signals, was admitted to the mental observation ward of the Citadel Military Hospital, Cairo, on February 3, 1939, with a provisional diagnosis of mental abnormality. He had three years service ; the last year he had spent in Egypt.

History.—He had complained of sore throat for a few days, though the fauces appeared normal and the pulse and temperature were normal. Salivation was noted. Stiffness of the left arm following a scratch on the elbow sustained at football was also mentioned. His friends stated that he would not eat or drink, and when offered a drink appeared to choke before it touched his lips. He was stated to be mentally confused, with speech slurred and consonants omitted.

On examination in hospital he was found to be in a state of intense excitement and restlessness, with rapid breathing and quick pulse. There were short intervals of calm when he appeared lucid, answering questions coherently. He inquired what was wrong with him, complained that he

was unable to drink and was anxious to be seen making the attempt. When offered some tea, he managed to get a little into his mouth but at once returned it. He denied any excess of alcohol, and said he had had no recent contact with animals.

The fauces had a normal appearance, and frothy saliva was expectorated at intervals. The heart and lungs were normal. No spasm of the limbs or trismus was present. The pupils reacted to light. Deep and superficial reflexes were normal.

The following diseases were considered as entering into the diagnosis: Delirium tremens, acute mania, hydrophobia, tetanus, and hysteria.

Hypnotics were administered but had only a temporary effect. Restlessness increased, and the patient became violently delirious requiring mechanical restraint. Cyanosis and coma supervened, with collapse, and death occurred at 6 a.m. the following day.

A post-mortem examination was performed by Major D. W. Beamish, M.C., D.A.D.P., British Troops in Egypt, and the following extracts are made from his report:

Brain.—The cerebral cortex is congested, the blood vessels on the outer surface of the brain showing signs of distension.

Lungs.—The pleura on the right side is thickened and adherent, the results of previous pleurisy. There is slight congestion of the lining of the intestines. Liver and kidneys have a normal appearance.

The stomach contents were examined by the Director of Public Health Laboratories who reported that the sample gave negative tests for alkaloids.

The brain was sent to the Anti-Rabic Institute and Hospital and the following report was received from the Director. Microscopic Examination: Several sections of the brain were examined and some Negri bodies were found. Biological Test: Four rabbits were inoculated on February 6 with brain substance, two intramuscularly and two subdurally. One developed symptoms of rabies on March 4.

Information was received from the unit that Driver M. was fond of dogs, and often had one under his care.

Travel.

ROAD TRAFFIC IN INDIA.

By Major R. A. ANDERSON,

Royal Army Medical Corps.

As both these journeys were performed some time ago, the details are given from memory; and apologies are offered, in advance, with regard to the first journey, if any errors have crept in.

The first journey was performed by a very senior and distinguished officer of the Indian Medical Service, on transfer from Dehra Dun to Rawalpindi in the month of November, 1936.

He left Dehra Dun about 8 o'clock in the morning in his car, and turned into Flashman's Hotel, Rawalpindi, that evening about dinner time. On arrival there he noticed that his speedometer registered the mileage of the journey as being 490 miles. Without pausing he determined to complete the 500 miles, and consequently proceeded up the Peshawar Road about five miles, and back again, thus registering in the day a journey of 500 miles in the space of about twelve hours. His car was one of the big Buicks, which, of course, is a very fine car. He had a driver with him, but I cannot say whether he drove all the way himself or alternated with the driver.

The road to Rawalpindi, once clear of Saharanpur and Pipli, on to the main Great North Road is an excellent one. I went over it myself in the following year, on the way up to Kashmir via Rawalpindi and Abbottabad.

I had never heard of such a magnificent run in one day as this, particularly in India. It was this run, therefore, which gave me a hankering ambition to endeavour to emulate it, and consequently led to run number two, described later.

A few notes here with regard to some differences in motoring in India, as compared with motoring at home, might not be amiss to those who are not acquainted with India. Generally speaking, the roads in India cannot be compared favourably with those at home. It must be admitted though that great strides forward have been made in India since my first tour over twenty years ago. In those days I cannot remember any road out here being tar-macadamized. Nowadays practically all the main roads are tarmac, but with this difference, that only a small part in the centre of wide roads is done, generally a width of 10 or 12 feet, which does not give a comfortable room for two cars to pass each other at speed without

one or both cars having the wheels on one side off the tarmac. Therein lies one of the greatest dangers of motoring in India: because the tarmac is usually confined at each side by a row of bricks or cement, which is anything from 2 to 6 inches higher than the rest of the road. The remainder of the road on either side of the tarmac strip generally consists of soil or sand. In dry weather this is exceedingly dangerous because of dry sand skids, and in wet weather it is even more so because it becomes very greasy mud. During the last year on that strip of road between Meerut and Delhi, a short distance of about forty miles, we have had two tragic accidents. One, a car conveying officers from Army Headquarters, Delhi, to a conference at Meerut, skidded into a tree, very seriously injuring two officers. The other accident was one, I think, of a lorry with a wheel off parked in the middle of the road without any lights at night. An officer proceeding from Meerut to Delhi met with a very tragic death.

So much for the road and its surface; next it is interesting to consider the kind of traffic on the roads in India. Firstly with regard to cities, towns and villages. Compared to home these are stretched out at much greater distances and consequently you do not generally have the delays of the 30 mile limit, etc. I have gone through many Indian towns with narrow crowded streets, through which you can only crawl, without any sign whatever on the approaches. Again I have often seen small villages with two or three houses on one side of the road and three or four on the other, with ridiculous signs outside of a 10 mile limit. I have on the other hand yet to come across anyone who pays the slightest attention to them.

Motor traffic calls for no comment, but the bugbears of motoring in India are the bullock-carts, camel-carts, herds of cows, buffaloes, goats and donkeys, and lastly the Indian himself. Only those with the most placid of dispositions could enjoy motoring in India. One has got to experience it to know the frantic fury into which the above can drive one. They are the slowest moving animals which can be imagined. Generally the Indian in charge of the carts is lying in the bottom of the cart asleep, night or day, and always they occupy the centre of the road. At night seldom is a light carried. After many years' experience I am rapidly coming to the conclusion that to hoot, even a mile away, is fatal. There is no idea in the native mind of road sense. The result of hooting to a string of bullock-carts is that some will go to the right, some to the left and the remainder will still be in the middle of the road when you are upon them, so where are you? There appears to be no traffic control whatever over these slow-moving objects outside towns and cities. Motor traffic has to pay for the roads by registration fees and I think is rightly entitled to the tarmac strip. Similarly there appears to be no control over these vehicles about carrying lights at night outside the towns, etc.

It is a well-known axiom "That things move slowly in the East." In no other country does this apply more so than in India. It apparently embraces legislation in the matter of the roads. Lastly with regard to the country Indians. They love to joywalk in the middle of the road. They are possessed of the most appalling absence of any form of road sense. Again it is a matter of opinion whether hooting at them is not fatal. One on the right hand side of the road, instead of staying there, will probably run right across the road in front of you to the other side, without looking. Similarly with regard to one on the left. If one meets a crowd, they would never think of all going in the same direction. Some scatter one way, the remainder the other, and then often a change of mind takes place, one or two of a group which have already started in one direction will suddenly turn and run across in the other direction. With regard to bicycles, to me these are a nightmare. The prevailing habit in India is two on a bicycle, sometimes one on a carrier behind (which is not so bad) but generally the second passenger sits on the crossbar in front of the one steering, who generally has not a clear view of the road in consequence. The majority of Indians appear to be unable to ride straight, always wobbling. These alone are enough to give one nerve strain. Those who are used to India will, I am sure, fully endorse the above.

Now for the second motor-car run:—

I had occasion to inspect at Nowgong towards the end of March 1937, and determined to try to make this my effort of a long run. Unfortunately for comfort I had chosen a very bad time of the year, because it was getting well into the hot weather then.

Nowgong is 60 or 80 miles beyond Jhansi. At this time I had to decide on the route to Delhi. The road between Roorkee and Meerut (about 70 to 80 miles) was appalling—full of potholes, rough and dusty, but worse than that, with wavy ridges across the road. I know of no other condition of a road which can shiver a car and do more damage to it. Consequently I decided to go the long way round to Delhi, through Saharanpur on to Pipli and there join the Great North Road straight down to Delhi. Although this added about 60 miles to the journey, it saved time in the end.

I got away from Dehra Dun about 5 a.m. I always keep a driver for my wife, but I myself only use him to look after the car, being one of those individuals who intensely dislike being driven, particularly so by any native. On this day's journey I was particulary lucky in that I had no breakdown whatever, not even a puncture to hold me up. With regard to speed there were many stretches of the road I was able to get along at 60 to 65. My car was a 20-70 Hillman which I had brought out from England this tour. It had done in

England about 15,000 miles and was at just about its zenith. Beyond the inevitable delays of bullock-carts, etc., on the road, breakfast and lunch, I had no delay of any consequence between Dehra Dun and Jhansi. Between Jhansi and Nowgong I had a delay of nearly one and a half hours to get over a river just outside Jhansi. The delay was due to a herd of cattle crossing at the time I arrived on one of those small bullock ferry-boats. This was the only way to get across. After that all went well and I arrived at Nowgong shortly after 7 p.m. The speedometer clocked 531 for the journey. I had driven all the way myself, and needless to say on arrival I had had just about enough of it. I would not like to duplicate the experience, as I consider I was lucky enough. The route was as follows: Dehra Dun, Saharanpur, Pipli, Delhi, Muttra, Agra, Gwalior, Jhansi, Nowgong.

Curiously I did not get the reaction until after I had returned to Dehra Dun. The return journey, after a day's interval, was done in two days and I had three punctures on the way back, which shows the luck of the road.

Before finishing I would like to add a few notes on tyres. The original tyres on this car were Dunlop Fort 90. They had done 15,000 in England. They continued to give good use in India. Three of them did 29,000 miles before I discarded them. One carried on to the huge amount of 33,000 miles and could have done some more, but as it had worn thin I was frightened to risk it further on account of the stray bullock shoe, which is generally worn to a razor edge before it falls off on to the road. I have never had any tyres before which have ever given me anything like these mileages. Shortly after this car had done 33,000 miles it began to show signs of requiring re-boring and I traded it for a new car, as I do not like an engine after re-boring. I consider the car had given me very good wear indeed and have known two others which required re-boring long before this mileage was reached. Perhaps I was lucky in the model. After the Nowgong run I took this car up to Kashmir and back and it was not disposed of until nearly a year a later, so apparently the long continuous run did not have any ill effects on it.

Echoes of the Past.

AN OUTLINE OF DENTISTRY IN THE BRITISH ARMY, 1626-1938.

By Major S. H. Woods, O.B.E.,
The Army Dental Corps.

(*Continued from page* 135).

By the end of the century, pikemen had disappeared on the introduction of the bayonet and the bandoleer had been displaced by the cartridge in which the powder and bullet were combined, thus greatly simplifying the loading of the musket. Thereafter, the whole of the infantry bit cartridges (fig. 3).

Fig 3.—"The Biting of the Cartridge," from "The Soldier's Companion," Lond., *c.* 1740.

Word of command	Explanation
"Handle Cartridge."	First movement: "Draw the cartridge from the pouch."
	Second movement: "Bring it to the mouth, holding it between the forefinger and thumb, and bite off the top of it."

(From "The Soldier's Companion," *circ.* 1740.)

The eighteenth century is a barren period as regards our subject, for no records were kept; only a few army surgeons published their experiences or cases, and none of these refer to dental treatment or gunshot wounds of the jaws. Men were billeted in the garrets of lodgings or ale-houses, while £30 per annum was allowed the regimental surgeon for the hire of accommodation for a so-called hospital.

In 1740 only two barracks were in existence in England but, by 1798, barracks sufficient to house some 20,000 men had been built and a hospital organization was instituted, with definite schedules of equipment including dental instruments. At the same time, instructions for the medical examination of recruits were introduced, but it was not till 1821 that defective teeth were mentioned as a cause for rejection, previous to which the non-medical recruiting staff were responsible for ensuring that the infantry recruit could bite a cartridge. Napoleon did not leave so important a matter to chance, for his Code for Conscription, 1810, gives precise instructions on this point (Table I).

TABLE I.—THE DENTAL STANDARDS, 1625 TO 1938.

1625–1695 :	Incisors and canines were required by	Musketeers (two-thirds Infantry) to open the bandoleer (powder charge).
1678–1810 :		Grenadiers (one company per regiment) to open the fuse of the grenade.
1695–1865 :		Whole of Infantry, to open the cartridge (combining powder-charge and bullet).

1798 : First instructions for medical inspection of recruits.

1821 : First mention of defective teeth as a cause of rejection (Hospital Regulations). "Deficiency of many teeth, and particularly if accompanied by an unsound state of the remainder."

1824–1865 : "Loss of many teeth, particularly of the incisors and canines."
(Compare Napoleon, Code of Conscription, 1810, "Loss of the incisors or canine teeth of the upper or lower jaw hindering the biting of the cartridge. A person without canine or incisor teeth cannot be a soldier of the line, but may be employed in other services.")

1865–1898 : "Loss of many teeth."

1899 : "Recruits must possess a sufficient number of sound teeth for efficient mastication."

1906–1914 : "Loss or decay of teeth to such an extent as to interfere materially with efficient mastication."

1921–1936 : "The eleven-point standard"—a simple, practical guide for medical officers :—

sound or reparable functional	incisors, canines, and premolars, count as one point each.
	first and second molars as two points each.
	third molars (according to development) as one or two points each.

Maximum possible points, 22.

Minimum points required, 11—namely 50% masticating efficiency.

1937 : The standard was modified for other than front-line troops.

1938 : All standards in abeyance.

In 1830 a category of causes of admission to hospital was introduced, in which "odontalgia" is included, suggesting that painful dental conditions were then common. In 1857 medical officers were requested by the Director-General, Army Medical Department, to conserve certain teeth rather than extract them in every case (*British Journ. Dent. Science*, May,

1857), for which purpose the set of filling instruments shown in fig. 4 and detailed in Table II was authorized.

Even in the most skilled hands, this set was ridiculously inadequate for any useful purpose, and medical officers very wisely refrained from

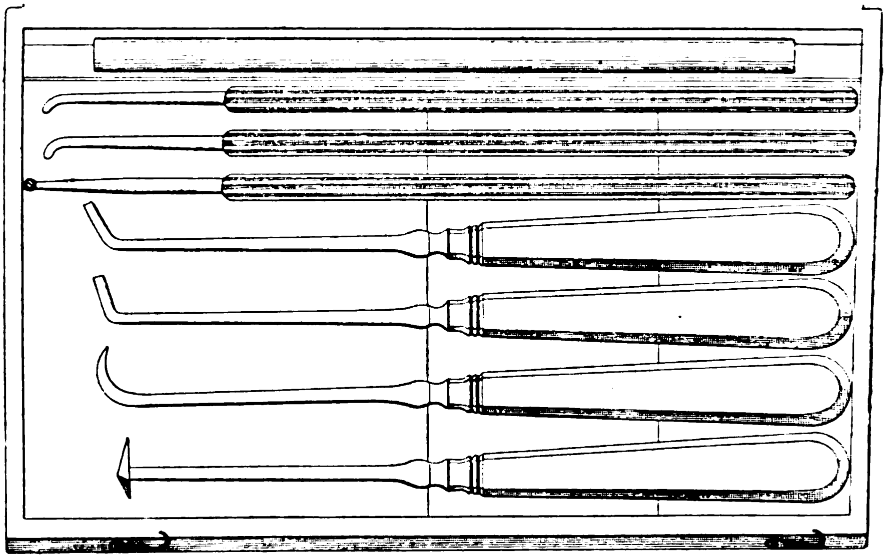


FIG. 4.—Set of instruments, stopping and scaling, 1857, illustrated in "Army Medical Equipment." 1866.

TABLE II.—REGIMENTAL HOSPITALS. AUTHORIZED DENTAL EQUIPMENT, 1798–1900.

1798–1820: 1 key instrument for teeth, to fit trephine handle

1820-1838: 1 key instrument
1 tooth forceps
1 tooth lever

1838–1857: 1 tooth key
2 tooth forceps
1 punch
1 gum lancet

1857–1900:

Set of extracting instruments:—
4 upper forceps, 4 lower forceps
4 forceps for children
1 set of six elevators to fit one handle
1 tooth key with three claws
1 spring gum lancet

Set of stopping and scaling instruments (fig. 4):—
2 stoppers
2 scalers
2 excavators
1 rosehead
sheets, gold leaf
amalgam
gutta-percha

using it, hence there is no record of the conservation of teeth in the army previous to the employment of dental surgeons in 1900 (Table III).

TABLE III.—DENTAL TREATMENT.

1626-1660 Pre-standing army	Extractions Scalings Gum treatments	by	Company-Surgeon—expected to be able "to draw a tooth well." (Woodall.) Mate—expected to be "not ignorant of tooth drawing."
1660-1900	Extractions only by regimental surgeons or mates.		
S. A. War—1900 (March-August)	General treatment by Mr. N. Pedley, Honorary Dental Surgeon, Imperial Yeomanry Hospital, Deelfontein.		
S. A. War—1901-1902	General treatment (except dentures and repairs) by 4 contract army dentists in the field.		
1903-1908	Conservative treatment by 8 contract army dentists in home commands.		
1909-1914	Limited conservative treatment by part-time civilian contract.		
1910-1914, *India*—	Conservative treatment by 3 contract army dentists.		
1914-1921	All necessary treatment by temporary army dental officers.		
1921-1938	All necessary treatment by The Army Dental Corps (the first regular dental officers).		

In 1860, dentistry became a separate profession and in 1880 the British Dental Association was formed, agitating from its inception for some measure of dental treatment for the soldier, but without success.

Meanwhile, wounds of the jaws and face by cannon, gunshot, sabre, and lance, were becoming increasingly frequent in the various campaigns, attracting the attention of army surgeons, a few of whom published their experiences of such cases (Table IV).

TABLE IV.—OBSERVATIONS ON MAXILLO-FACIAL INJURIES (19TH CENTURY).

(1) "Report on the Wounded at Waterloo," by John Thomson, Surgeon to the Forces, 1816.

"Musket-balls seldom enter the mouth without fracturing the jaws, several cases of which were seen. In passing through the upper part of the mouth, the balls had not only fractured the upper jaw, but they had also destroyed portions of the palate and removed the partition dividing the mouth from the nose. Fractures of the lower jaw, upon one or both sides, were very common. Few of these ever heal without distortion of the face; tedious exfoliations of bone take place and the fractured extremities occasionally show no disposition to unite by callus."

It would appear that, at this time, cases were more or less left to Nature.

(2) "Principles of Military Surgery," by John Hennen, Deputy Inspector of Military Hospitals, 1818.

"It is astonishing how little beyond simple dressing is required in the most serious looking penetrating wounds about the mouth and cheeks, but it becomes a very different matter if the bone, particularly the lower jaw, is fractured or has sustained a loss of substance. The powerful and opposite muscles inserted into it render it difficult, if not impossible, to prevent great deformity. If the bone is divided into two portions, apply the lower jaw closely in contact with the upper, which must be viewed in the light of a fixed splint, supporting the part by a properly adapted roller over the fractured points. The patient must keep his mouth closed and his food must be altogether fluid. Loosened teeth form a great source of irritation, and should be removed as soon as possible, for I have never seen the attempt to save them productive of ultimate good."

(3) "The Surgeon's Pocket Book," by Surgeon-Major J. H. Porter, 1875.

In the chapter on wounds of the face and adjacent parts, he mentions—

Upper jaw: Replacement of fragments as far as possible; cold water dressings: approximation of soft tissues with adhesive plaster.

Lower jaw: More numerous and troublesome; difficulty of reducing displacement and maintaining position; difficulty of feeding and incessant flow of saliva.

Treatment: Gutta-percha splint; four-tailed bandage; ligature of contiguous teeth with silver wire or silk; bandaging combined with open wedging of posterior fragments; fluid diet through long tube; morphia.

Description of Case.—"At Redan in 1855, an officer received a bullet wound at the ala of the right nostril, which smashed most of his teeth in both jaws, broke in the hard palate, lacerated the tongue extensively, and broke the lower jaw in several places. His condition was that of extreme wretchedness, but by adjustments of the parts, removal of splinters and support by means of the gutta-percha splint, he was made comparatively comfortable. Suppuration was profuse and the wounds remained open for a considerable time, but he so far recovered as to be able to perform the duties of a field officer, having had a false palate and several teeth adapted to his mouth."

In 1878, a sheet of gutta-percha for moulding round fractured jaws was added to the equipment in the field, and medical officers were trained in its use at the Army Medical School, Netley, during the course in military surgery.

At the outset of the South African War in October 1899, no provision was made for the dental treatment of the force in the field. Mr. Newland Pedley, on the staff of Guy's Hospital Dental School, went out in February 1900, for six months, as honorary dental surgeon with the Imperial Yeomanry Hospital, Deelfontein (founded by voluntary subscription), and he was the first dentist to treat the soldier in war.

The British Dental Association, perturbed by reports of serious dental sick-wastage, approached the War Secretary, who was sufficiently impressed to appoint four contract dentists for the troops in 1901—the first paid army dentists (Table V).

TABLE V.—DENTAL PERSONNEL, SOUTH AFRICAN WAR.

Report by Mr. N. Pedley, Honorary Dental Surgeon, Yeomanry Hospitals, March-August 1900.

(*a*) "Disease, neglect, tough beef and hard biscuit play havoc with the teeth."

(*b*) "Nothing is done to preserve the soldier's teeth whilst he has any, and when they are gone, he must go home as a man unfit for service."

(*c*) "Had very few severe gunshot cases which were treated in conjunction with Mr. Alfred Fripp (consulting surgeon.)"

The First Paid Dental Surgeons to treat Troops in the Field, 1901.

J. K. Clark (Bloemfontein).
E. W. Corfe (Elandsfontein).
J. B. Gillies (Norvals Point).
W. B. Woodhouse (Pretoria).

No Army status—pay, £1 a day and captain's allowances—supplied own filling instruments—Government supplied necessary furniture and materials.

Report of these Four Dentists on Return from the S.A. War.

(*a*) No mechanical appliances were supplied in the outfit, hence no dentures could be made or repaired.

(*b*) Most extractions without anæsthetic—when required, chloroform was administered by an Army surgeon.

(*c*) Last drafts sent out had extremely defective teeth—most of these men were useless as fighting units, being unable to masticate the diet of tough meat and hard biscuits.

TABLE VI.—OFFICIAL STATISTICS—SOUTH AFRICAN WAR, 1899-1902.

Dental Report.

"There was among men with the Colours not only a considerable prevalence of dental caries, but a septic condition of the mouth was almost more common.

Caries of the teeth and its accompaniments, including pyorrhœa, was much more important than is shown by the admissions to hospital, and was a very serious matter in relation to inefficiency.

Of 6,942 admissions to hospital for caries, etc., about one-third were invalided to England, the remaining two-thirds were nominally returned to duty, but many of them were unfit for duty in the field and had to be kept within reach of soft food."

Dental Sick-wastage, South African War.

Average ration strength in the field	Number of admissions to hospital for dental disabilities	Number of these invalided to England as unfit for service
208,300	6,942	2,451 (1·2 per cent. of total effective force).

After the campaign, eight whole-time army dentists were appointed to the home commands, but were superseded in 1908 by a system of local part-time civilian contract. As for India, where the British troops had been neglected, three whole-time contract dentists were appointed in 1910 (Table VII).

TABLE VII.—DENTAL PERSONNEL, 1904–1914.

First Dental Surgeons to Treat Troops in Peace Time. April, 1904, *to March,* 1908.

(Home Commands Only.)

J. K. Clark, Aldershot.	J. B. Gillies, Dublin.
C. de Foubert, Cork.	H. G. H. Cowell, Edinburgh.
A. Rice, Woolwich.	C. W. Randall, Colchester.
A. F. A. Howe, Portsmouth.	H. C. Toone, Devonport.

Contract—£1 a day and travelling expenses—no rank or army status—no uniform—supplied with up-to-date equipment. Estimated cost, £5,000 per annum.

They were superseded in 1908 by local civilian part-time contract.

First Dental Surgeons for British Troops in India, 1910–1914.

J. Carr. F. Byrne. J. P. Helliwell.

Whole-time contract; conservative treatment only; no rank or army status.

Meanwhile, the Army Medical Service had been reorganized, and dentistry was included in the subjects in which officers at the Royal Army Medical College, London, could be graded as "specialist" after taking a course in the subject. Accordingly, clinical teachers in dentistry were appointed, but only four "dental specialists" were graded in six years, and were not employed in such capacity. The scheme was abandoned in 1908 (Table VIII).

TABLE VIII.—COURSE IN DENTISTRY FOR R.A.M.C. OFFICERS, 1903–1908.

Clinical Teachers—

1903, J. H. Badcock, F.R.C.S., L.D.S.
1904–1906, W. A. Maggs, M.R.C.S., L.D.S.
1906–1908, M. F. Hopson, L.D.S.

External Examiner—

Mr. Paterson, M.R.C.S., L.D.S.

The Courses were given at Guy's Hospital Dental School.

The following were graded as "specialists" in dentistry:—

Majors J. H. Pocock; B. W. Longhurst; J. B. Cautley; H. C. Wentworth.

It may therefore be said that, at the outbreak of the Great War in 1914, dental treatment for the soldier was negligible. No provision whatever had been made for treatment in the field, and no dental officer accompanied the expeditionary force to France. As everyone knows, the authorities were lamentably slow to recognize the necessity of, and to make provision for, dental treatment at home and in the field. It was not till May, 1918, when Major Helliwell, then Senior Dental Officer in the London District, was appointed to the War Office in an advisory capacity, with the rank of Lieutenant-Colonel, that anything like organized and effective measures were taken (Table IX).

TABLE IX.—NUMBER OF DENTAL OFFICERS, HOME AND IN THE FIELD, 1914–1918.

Year			
1914	August to October	None with Expeditionary Force	
	November	12	for France only
	December	20	for France only
1915	February	36	(Including the first for Home)
	May	57	
	August	150	
1916	August	300	(Compulsory Service Act)
	December	463	
1917	December	501	
1918	May	(Lieutenant-Colonel Helliwell appointed to War Office in advisory capacity)	
	August	714	
	November	850	

(*Official Medical Statistics of the Great War*, 1931.)

One lesson of the war was that men dependent on dentures are potential inefficients, for dentures are so easily lost or broken, wilfully or accidentally. There was a constant stream of thousands of men from army areas to the base, for the fitting of new dentures and repairs—a wastage of effectives which seriously perturbed army commanders. This experience profoundly influenced subsequent army dental policy, and the denture

TABLE X.—ARMY ADVISORY STANDING COMMITTEE ON MAXILLO-FACIAL INJURIES, MAY, 1932.

CONSTITUTION OF THE COMMITTEE.

Chairman:

Colonel J. P. HELLIWELL, C.B.E., Director, Army Dental Service, War Office.

Members:

*Mr. W. KELSEY FRY, M.C., M.R.C.S., L.D.S.
Sir HAROLD D. GILLIES, C.B.E., F.R.C.S.
Mr. W. WARWICK JAMES, O.B.E., F.R.C.S., L.D.S.

Secretary:

Major S. H. WOODS, O.B.E.

* Nominated by the British Dental Association.

TERMS OF REFERENCE.

To investigate and report on the treatment of maxillo-facial injuries and to make recommendations in regard to:—

(i) The provision and equipment of special hospitals or departments for these cases;
(ii) general methods of treatment, and
(iii) the training of dental officers in the principles of preliminary treatment in the field.

(The Report, made in June, 1935, is an official publication.)

question still remains a major problem of its own. Another lesson of the war was the high incidence of wounds of the face and jaws in modern warfare, requiring specialized treatment by an organized maxillo-facial team of surgeons and dental officers. An Army Advisory Committee was formed in 1932 to deal with all matters relating to this subject (Table X.)

TABLE XI.—TREATMENT BY THE ARMY DENTAL CORPS.

Recruits.

On joining, the recruit is inspected and he is rendered dentally fit during his three months' training, every effort being made to conserve defective teeth. A large proportion of the dental officers at home are detailed for this intensive treatment of the recruit.

Year	Number inspected	Number requiring treatment	Average requirement per man
1936	23,455	23,182 (99%)	2·5 extractions 4·5 conservations

Trained Soldiers.

The recruit joins his regiment as a trained soldier and is dentally inspected annually in March. Continuation treatment is given by the dental officer in the area to maintain dental fitness. All drafts for foreign service are inspected and rendered dentally fit prior to embarkation. Necessary dentures are supplied.

Year	Number inspected	Number requiring treatment	Average requirement per man
1936	139,004	75,850 (55%)	1·5 conservations

Year 1936. *Annual Dental Report.*

Teeth conserved ..	254,182	New dentures supplied ..	2,172
Teeth extracted ..	98,520	Dentures repaired	2,471
Scalings	42,978	Fractures of jaws	120
Gum treatments ..	2,706	Jaw appliances made ..	59

Personnel Treated.—Officers; other ranks; families of soldiers; boys in technical schools; Royal Naval and Royal Air Force personnel at stations abroad.

TABLE XII.—THE ARMY DENTAL CORPS PERSONNEL, 1921-1938.

Year	Administrative officers (excluding a Director at the War Office)		Total establishment of officers
1921	4 Majors	(Joint service for Army and Air Force)	110
1930	4 Majors	Air Force section separated to form R.A.F. dental service	
1935 (September)	4 Lieutenant-Colonels		124
1935 (October)	2 Colonels 9 Lieutenant-Colonels		150
1938 (August)	Same		162

Normal Geographical Distribution (1938).

Home Commands ..	112	India	30
Gibraltar	1	Burma	1
Malta	2	Malaya	3
Egypt	7	Hong Kong ..	3
Sudan	1	North China ..	1
Palestine	1		

Summary: Home 112; abroad 50; total 162.

Other Ranks.

Dental Mechanics.—These are trained at The Army Dental Corps School of Instruction, Aldershot, in denture work and the making of appliances and splints for maxillo-facial injuries.

With exception of one small laboratory in the London district, all the denture work at home is undertaken at the Central Laboratory, Aldershot.

Abroad, mechanics are posted to Command laboratories or to single dental centres. Establishment (1938)—40.

Dental Clerk-orderlies.—These are trained at The Army Dental Corps School of Instruction, Aldershot, in the duties of surgery-attendant and clerk. 1 clerk-orderly is allotted to each officer. Establishment (1938)—170.

In the introduction to the Army Estimates for 1921, it is said that :—

"Sound teeth in the soldier are of prime importance and an army dentally fit will have reduced rates of sickness and invaliding. A proposal has, therefore, been put forward for the formation of a Dental Corps to consist of 110 officers and 132 other ranks (mechanics and orderlies) for which it is hoped approval will be obtained.

By Royal Warrant dated January 4, 1921, The Army Dental Corps was formed, under Lieutenant-Colonel Helliwell at the War Office, when. for the first time, an organized, comprehensive, continuous scheme of dental treatment became available to the soldier throughout his service.

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Current Literature.

Smith, W. & Andrewes, C. H. **Serological Races of Influenza Virus.** *Brit. J. Exper. Path.* 1938, v. 19, 293–314, 8 charts. [14 refs.]

In this paper the authors describe a series of observations on the antigenic heterogeneity of different strains of human influenza virus which are comparable with those recorded by Francis and Magill. Their technique differed from that used by the latter authors in three ways. The antisera employed were obtained from convalescent ferrets instead of from immunized rabbits. The strains of virus were maintained by mouse-passage, not by tissue-culture. And the end-point in titrations by the mouse-protection test was determined by the presence or absence of lung lesions, not by death or survival.

When twenty-eight strains of human influenza virus were tested by this method, clear evidence was obtained of the presence of many different antigenic components. Of these, four appeared to possess major significance, and were present in very different proportions in the different strains. The authors found that the strains examined by them could be classified in three categories—those that were highly specific, their antigenic behaviour being

dominated by one or other of the four major antigens ; those that were less specific ; and those that were relatively non-specific, behaving as though they contained all four antigenic components in sufficient amount to respond to each of the corresponding antisera, and to stimulate the production of the corresponding antibodies.

When mice were actively immunized with the different strains it was found that protection was most complete against the homologous virus, and that the presence or absence of protection against heterologous strains was determined mainly by similarity or dissimilarity of antigenic structure.

If normal mice were replaced by ferrets that had recovered from an infection by one or other of the strains of virus under test, it was found that active immunization with any strain tended to induce an immunity that was less specific, suggesting that animals with a basal immunity may respond better to the stimulus provided by minor antigenic components.

In discussing the bearing of these findings on the problem of active prophylactic immunization in man, the authors note that a non-specific or " master " strain of virus offers the obvious advantage that it will, if given in adequate dosage, confer resistance against all the more specific types. It happens, however, that the most non-specific strain in their possession is much less active, i.e. will produce infection at much lower titre, than certain of their more specific strains. In such a case it is clearly necessary to balance the advantages of non-specificity against the disadvantages of smaller dosage. The difficulty of reaching a decision is increased by the fact that the adult human subject will, on the average, possess some basal immunity, and may thus behave like the recovered ferret rather than the normal mouse, in which case differences in antigenic structure may be less important than differences in dosage. W. W. C. TOPLEY.

Reprinted from " Bulletin of Hygiene," Vol. 14, *No.* 3.

CRUICKSHANK, R., and GODBER, G. E. **The Aerial Spread of Streptococcal Infections.** *Lancet.* 1939, April 1, 741–6. [27 refs.]

After a brief review of the previous evidence of air-borne infection an account is given of combined clinical, bacteriological and epidemiological investigations into two small outbreaks of puerperal sepsis and into streptococcal infections in wards of children admitted with diphtheria. In the first outbreak of puerperal sepsis six patients were infected with Type 25 *Str. pyogenes.* Three of them were vaginal carriers during the puerperium without showing any evidence of clinical infection, which justifies a bacteriological examination of the genital tract of all patient-contacts in any institutional outbreak of puerperal sepsis. The hæmolytic streptococcus was not discovered in the upper respiratory tract of any of the attendants on them and there was no common attendant responsible for the confinements. The aseptic and antiseptic precautions taken made extremely unlikely the transference of infection by the hands of nurses, instruments

or bedpans, and the originally infected patient was removed from the ward before the others were confined. If these later patients were infected after confinement there was, therefore, no chance of direct transference of the organism and presumably it was derived from an atmosphere already contaminated through the presence in the ward of the first infected patient for two days. Another small outbreak of three cases of puerperal infection and three of tonsillitis, again due to Type 25, was probably originated by a nurse who was a streptococcal carrier. No other carrier amongst the staff was discovered, and the occurrence of two clinical cases of infection some days after the only carrier was taken off duty points to some other reservoir of infection. That this was probably the infected dust or air is supported by the fact that these were infections of the upper respiratory tract. Direct evidence of an aerial source was not obtained, but the wards had been disinfected before the atmosphere was bacteriologically examined.

An outbreak of streptococcal infection in a diphtheria ward showed two epidemic waves coinciding with the introduction of two streptococcal types by patients with faucial infection. The first, with Type 12, was brief, possibly because the ward was in quarantine and its population unchanged. The second type, Type 6, principally affected those who had escaped the first attack and afterwards newly admitted patients sustained the bulk of the infection. The children were all in bed and the beds were adequately spaced. None of the staff was a carrier of the epidemic types. Manual transference by nurses or spread by fomites could not be excluded, but infected air appeared to be a more likely source of infection. The epidemic types were found on plates exposed to the air and were most numerous where the brunt of the infection in the ward occurred and after the dust had been stirred up by cleaning in the early morning. Other similar examples are given.

In general the failures to control institutional outbreaks of streptococcal infection by orthodox methods point to some unconsidered factor which from the accumulated evidence the authors believe to be the infected dust and atmosphere. Cleansing of the polluted air by free ventilation and the removal of infected dust by damp sweeping and dusting are two simple and probably effective measures for the prevention of air-borne streptococcal infection. A. Bradford Hill.

Reprinted from "Bulletin of Hygiene," Vol. 14, *No.* 7.

Hass, G. Staubmasken und Staubfilter. Ihre Wirksamkeit und ihr Atemwiderstand. Grenzen ihrer Anwendbarkeit in Betrieben der Industrie der Steine und Erden. [Dust Masks and Filters.] *Arch. f. Gewerbepath. u. Gewerbehyg.* 1938, v. 9, 97–112, 12 figs.

In a consideration of dust respirators used to prevent the penetration of the finest silicotic particles, the author states that those used at present are of very different types and indeed of doubtful value. It is considered that the resistance to their use shown by workers is not without justifica-

tion. Dust filters (evidently as used in Germany) are divided into three groups :—

(1) Fine-dust filters which in the tests later described showed an efficiency of more than 90 per cent, in some cases 97 per cent. The names of the firms producing these filters are given. These filters have both a coarse and fine dust filter utilized in series. The former consists mainly of loosely-packed wadding and traps the coarser particles completely as well as a not insignificant amount of the finer particles. This preliminary filtering of the larger particles prevents the too-rapid blockage of the pores of the fine-dust filter, which consists of a fine-pored fabric (mikro hermeta) or of a paper mass. By suitable design a large surface is obtained and hence a bearable resistance to breathing. These filters require frequent replacement of the coarse-particle pad.

(2) Filters consisting of wadding. These the author declares not to be protective against fine dust, the best of them not giving more than 60 per cent efficiency. It is particularly stressed that ordinary wadding is not suitable; only that specially prepared by the producers of the masks is of use. Advantages of these masks are the low resistance and the compact form.

(3) Filters consisting of natural or rubber sponges. The effectiveness of these against fine particles is very poor and should never be used in silicotic trades. It is a strange thing that it is precisely this type of filter which is widely used and in the most dangerous jobs, perhaps because of cheapness.

In testing the usefulness of a mask and filter, data on the following matters must be obtained ; efficiency against dusts, resistance to breathing, fit to the face, subjective impressions on wearing the mask and the visual field. The efficiency against dust and the resistance were both measured on a single apparatus consisting of a suction pump which drew the dust laden air (quartz dust) through the mask or filter, fitted on a " test-head," to a Tyndallometer; the pressure being read on a water manometer. The volume of air drawn through the apparatus varied from 7–75 $\frac{\text{litres}}{\text{min}}$. Many masks were found greatly to lose in usefulness because of the impossibility of attaining an air-tight fit to the face. Any significant limitation of the field of vision by mask may be a source of accidents. With filters of a very high efficiency (92–99 per cent) the resistance to the passage of 10 $\frac{\text{litres}}{\text{min.}}$ was 2–3 mm. water pressure; to 30 $\frac{\text{litres}}{\text{min.}}$ 6·5–10 mm. water pressure and to 50 $\frac{\text{litres}}{\text{min.}}$ it was 11·5–16 mm. water pressure.

Examples are given of modern filters which are a great improvement on older types in the matter of lightness, always a very potent factor in the readiness of co-operation on the part of the worker.

M. W. Goldblatt.

Reprinted from " Bulletin of Hygiene," Vol. 14, *No.* 7.

Reviews.

Report of the Surgeon-General, United States Army, 1938. Pp. 266. Washington: United States Government Printing Office. Price 35 Cents.

The annual strength of the United States Army during the calendar year 1937 was, according to the Surgeon-General's Statistics, 175,624; this is an increase of 10,000 over the strength for 1936 and was due almost entirely to an influx of white enlisted men.

The total number of enlistments, original and re-enlistments, was 80,194; of which white recruits comprised 93·4 per cent, an increase of 7·6 per cent over the number of whites recruited in 1936.

As regards the health of the United States Army—the downward trend in the admission rate still continues.

The rate per 1,000 strength of personnel was 619 as against 633 for the previous year.

The principal causes of " admission to sick report " of the whole Army in order of frequency were influenza, tonsillitis, bronchitis, athletic exercise and gonorrhœa.

As regards locality, the admission rate for white soldiers was highest in Panama, China and the Philippines.

The death-rate for the whole U.S. Army was 3·48 per 1,000—the lowest for the last eleven years.

Of the total of 611 deaths, 329 resulted from disease and 282 from external causes.

The principal physical causes of death were motor accidents and suicides, while pneumonia came next in order and led the list of causes of death from disease.

The discharge ratio on account of disease for the year under consideration was 14·9 per 1,000.

The leading causes of discharge were dementia præcox, pes planus and tuberculosis. In the report special note is made of the prevalence of dementia præcox; no satisfactory procedure for its elimination at the time of enlistment has yet been found.

Amongst the white enlisted men discharged because of disease 62·6 per cent were in their first year of service.

The daily non-effective rate was 30 per 1,000, or stated in another way 3 per cent of the daily strength is lost because of illness.

The non-effective rate is the product of the daily admission rate, which for the year in question was 1·7 per 1,000, and the average length of treatment which was 17·5. The non-effective rate, therefore, was 29·7 per 1,000.

The total days lost because of illness was 1,903,753 as compared with 1,841,813 of the previous year.

The greatest loss of time was again due to gonorrhœa.

The rates for the principal infectious diseases for the total Army were :—

Influenza	41·1	per 1,000
Gonorrhœa	21·3	,,
Trichophytosis	11·3	,,
Mumps	8·9	,,
Syphilis..	7·9	,,
Malaria	5·6	,,

Pneumonia was much more prevalent probably because of the increase in influenza.

A graph showing the trend of the venereal rate since 1819 illustrates very markedly the effect of control measures instituted in 1909 when compulsory prophylaxis was introduced and monthly physical inspections were carried out, with forfeiture of pay for those who contracted the disease.

It is considered that there is every reason why these control measures should continue to be enforced. The view held is that a soldier suffering from venereal disease is a military liability through his own misconduct. Venereal diseases are costing the Army probably more than a million and a half dollars per year for treatment, and are responsible for over 18 per cent of the non-effectiveness due to disease.

There was an abrupt increase in the number of cases of typhoid fever. Of the coloured soldiers infected in the Philippines water was the probable source, while only in one of the three white cases was a source discovered and that was thought to be a carrier.

In the United States five whites were infected by drinking contaminated water from shallow wells and small streams—all except one had been vaccinated against typhoid, but the vaccination had preceded the onset of the disease by three years or more.

The Medical Department of the Planning and Training Division of the Surgeon-General's Office has continued research work in effecting the modernization of equipment and transportation for medical service.

Considerable progress has been made in the development of the Mobile Surgical Hospital. This unit consists of four semi-trailers with van type bodies. Two of these are being fitted as operating room vans, one as a sterilization van and one as a kitchen van.

The development of the light four-wheel-drive cross-country motor ambulance has been practically completed. It will carry four lying or five sitting cases. It has had considerable field testing and gives promise of solving the problem of a car which will be satisfactory for cross-country front line service.

A new horse-drawn ambulance capable of carrying four lying cases intended for service with the cavalry, and in situations impracticable for the operation of a motor ambulance, has been constructed and field tests will shortly be carried out.

Surgery of Pain. By Professor Rene Leriche (Strasbourg). Translated into English by Archibald Young, Regius Professor of Surgery, Glasgow. 1939. Pp. xii + 496. London : Baillière, Tindall and Cox. Price 21s.

In a preface the translator refers to the "ceaseless struggle against pain, in which the human race has been engaged from earliest times" and points out that surgical methods of treatment are only now beginning to engage serious attention, though much of the work which led up to this change of attitude commenced during or just after the Great War, when so many cases of painful amputation stump (causalgia, etc.) demanded investigation and treatment.

This book of 496 pages and a few good illustrations will be well worth reading by those who can afford the time to do so. It consists of a series of lectures by the author on the questions of the true nature of pain, its origin, paths of conduction, with in particular the various causes of it, and stressing the writer's conviction concerning the part played by the sympathetic nervous system. He brings out his arguments by illustrating facial and traumatic neuralgias, causalgia and painful nerve "bulbs," vasospasm, vasoconstriction with arteritis, angina, etc.

He makes a point of the diagnostic value of abolition of pain by cocainization and discusses the various treatments, without going into operative technique. It will soon be apparent to the reader that this is the work of an individualist, and although some of his views will not meet with universal acceptance, it is difficult not to be carried away by his lucid expression, clear description of case histories, and his enthusiasm. The work is reminiscent of that of Head and Sir James Mackenzie.

The printing is clear and good, and it is certain that the author's work has lost nothing in the translating. D.C.M.

Anatomy (Lower Extremity). Part II. By C. R. Whittaker, F.R.C.S. Edin., F.R.S.Edin. Fifth Edition. Catechism Series. 1938. Pp. 73. Edinburgh : E. and S. Livingstone. Price 1s. 6d.

This short book of 73 pages contains the essentials of the anatomy of the lower extremity, including ossifications and surface markings. It will be of use to those revising their anatomy for examination purposes.

J.W.

Aids to Public Health. By Llywelyn Roberts, M.D., D.P.H. Fourth Edition. Illustrated. 1938. Pp. viii + 263. Price 4s.

Aids to Sanitary Science and Law. By C. F. White, M.B., Ch.B., D.P.H., D.T.M. Revised by W. Hanna, M.A., M.D., D.P.H. Third Edition. 1939. Pp. vi + 361. Price 5s.

AIDS TO DERMATOLOGY AND VENEREAL DISEASE. By R. M. B. Mackenna, M.D., B.Ch., M.R.C.P. Second Edition. 1939. Pp. vii + 284. London: Baillière, Tindall and Cox. Price 4s. 6d.

These three recently published little books contain much valuable material within their pages, and though much condensed the subject matter is given in a very readable form in each case.

The principles of the subjects treated are given with accuracy and the books may be considered, within the compass of a pocket manual in each case, to give informative pictures of the subjects with which they deal.

Medical students in general and many practising medical men will find these little books of assistance, while those dealing with public health and sanitary law will be of great help to candidates for the D.P.H and for the Sanitary Inspectors certificate.

A.E.R.

CARBON MONOXIDE ASPHYXIA. By Cecil K. Drinker, M.D., D.Sc. 1939. Pp. xx + 276. London: Oxford University Press, Sir Humphrey Milford. Price 25s. net.

This valuable book covers the whole field of carbon monoxide asphyxia in a detailed and interesting manner and brings us up to date as regards all the more recent investigations and research in connexion with this most important matter.

The respiratory physiology and biochemistry of this form of asphyxia, together with the signs and symptoms of acute and chronic poisoning with carbon monoxide and the after effects, are fully dealt with; while common sources of the gas and the atmospheric percentages likely to be met with in different circumstances are given in detail.

The author has been careful to give full consideration to the subject of what constitutes harmful exposure to the gas, and has dealt very adequately with the treatment and the pathology of poisoning by it.

Finally, methods of detection in blood and in the atmosphere are described, and measures of prevention discussed.

The book is full of interest and the subject matter is given in a thoroughly readable form.

Although the author has written the book primarily for the benefit of those who are concerned with carbon monoxide poisoning from the practical point of view in civil life, it is a volume which, in these days of increased carbon monoxide production both in war and peace, should undoubtedly be on the shelves of all medical officers of the fighting services and of those medical men who have responsibilities in connexion with air raid precautions.

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No. 4 October, 1939. Vol. LXXIII.

Journal of the Royal Army Medical Corps

ISSUED MONTHLY

EDITOR.
COLONEL SIR WILLIAM H. HORROCKS, K.C.M.G., C.B.

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JOHN BALE, SONS & CURNOW, LTD.
83-91, GREAT TITCHFIELD STREET, LONDON, W.1

Price Two Shillings and Sixpence net

Vol. LXXIII. October, 1939. No. 4

Journal
of the
Royal Army Medical Corps.

Original Communications.

PREVENTIVE MEDICINE IN RELATION TO AVIATION.[1]

By Air Commodore H. E. WHITTINGHAM, C.B.E., K.H.P., F.R.C.P.Ed., D.P.H.

Aviation has progressed to a remarkable degree during the last decade, and more especially in the past three years, when this country, like many others, has become air-minded and record after record has been broken. In 1935, when King George V reviewed his Air Force at Duxford, on the occasion of his Jubilee, the expression that there was "a lot of sky" was common. Now, the picture is entirely changed: aeroplanes are to be seen daily; there are over 200 Service and civil aerodromes, excluding privately owned ones, in England alone, and all types of aircraft have been greatly improved as regards carrying-power, comfort, speed, and range of flight. To-day Service machines travel at speeds varying between 180 to 350 miles an hour and have flown non-stop for 7,162 miles; and the new air-liners of Imperial Airways have a top speed of 250 miles an hour and cruise at 200 miles an hour while carrying 40 passengers plus cargo. Many aeroplanes leave this country daily for foreign parts, and air-routes to various parts of the Empire have been opened and speeded up. The popularity of flying and the air-mindedness of the nation have been shown by the King's visits by aeroplane to R.A.F. stations; the recent holiday trip of the Duke and Duchess of Gloucester to East Africa; the historic journeying by Mr. Chamberlain to and from Germany during the crisis of September, 1938, when time was most important; the flights of Cabinet Ministers and other high officials to outposts of Empire to help settle some difficult problem by personal contact; and the wide use of air travel by business men

[1] Reprinted by kind permission from the *Proceedings of the Royal Society of Medicine*, vol. xxxii, p. 455. (United Services Section, p. 1).

for financial gain, and by Service men to obtain the maximum number of days' leave at home.

This development of aviation is not an unmixed blessing for, though it has greatly increased the rapidity of transport between one country and another, and between continents—and so has brought various parts of the world closer together as regards time—it is a most deadly implement of war and there is the added danger of aircraft conveying infectious diseases, either by means of passengers or insects. This danger was foreseen several years ago by the health authorities in many countries, with the result that the International Sanitary Convention for Aerial Navigation was drawn up at the Hague in April, 1933, and has since been ratified by practically all countries in the world.

In this paper it is proposed to deal with preventive medicine, as far as it affects aviation, under two main headings :—

I.—The protection of communities against diseases liable to be imported by aircraft.

II.—The protection of flying personnel against diseases due to flying.

I.—The Protection of Communities against Diseases Liable to be Imported by Aircraft.

The safeguarding of the masses against infection is of greater importance in public health administration than that of the individual, and it is justifiable, therefore, to consider this matter first. Journeys by air, from countries where the major infectious diseases (cholera, plague, smallpox, typhus, and yellow fever) are endemic to non-infected yet susceptible countries, are so rapid that they are usually completed well within the incubation periods of these diseases. This was pointed out by Air Commodore D. Munro (1925), and Massey (1933), and Table I demonstrates that the danger of importing these diseases to various countries by air is considerable unless adequate protective measures are undertaken by all concerned.

Table I.—Showing the Relationship between the Incubation Periods for the Major Infectious Diseases and the Time Taken to Complete the Journey by Air Between Endemic Zones and the United Kingdom.

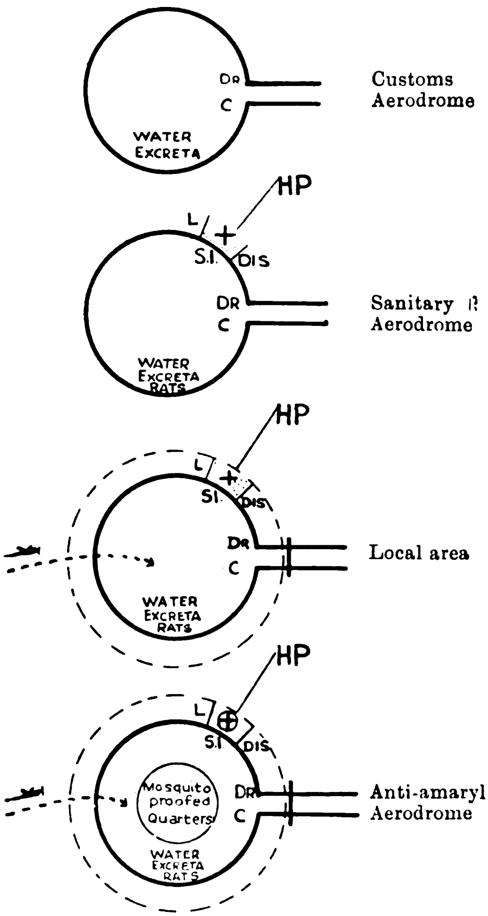
Disease	Incubation period (days)	Endemic area	Time taken to complete journey by air from endemic area to U.K. (days)
Cholera	2-5	India	4-5
		Iraq	2-3
Plague	2-6	India	4-5
		Iraq	2-3
		East Africa	4
		West Africa	3-5
		South America	4-5
Smallpox	10-14	India	4-5
		Iraq	2-3
Typhus	5-12	Central Europe	2
		Russia	2
Yellow fever	3-6	West Africa	3-5
		South America	4-5

The administrative machinery for the health control of air-traffic is based on the International Sanitary Convention for Aerial Navigation, 1933, which specifies the maximum measures that may be imposed for this purpose, but leaves their actual application to each country concerned, the general aim being to make the necessary regulations as uniform as possible to lessen inconvenience to passengers and to cause the minimum of delay to air transport, otherwise the main object of such mode of travel would be defeated. The Office International d'Hygiène Publique, in Paris, through its Air Navigation Quarantine Commission, deals with the application of the Convention and continually keeps matters concerning the sanitary control of aircraft under review from an international aspect, while through its delegates it maintains a close touch with the various governments who have ratified the Convention: it is, in fact, an international health-controlling bureau with the power to draft international agreements. The Health Organization of the League of Nations, on the other hand, provides an international intelligence service which promptly informs the health authorities throughout the world of the incidence of infectious diseases at various ports and airports. This epidemiological information is passed on weekly to the appropriate medical officers of health of each country by the health department of the government concerned, so that they are in possession of up-to-date particulars regarding infectious diseases and epidemics, occurring both at home and abroad. Thus, in the United Kingdom, this information is published and distributed by the Ministry of Health weekly through the agency of their "Weekly Record of Infectious Diseases at Ports, &c." and by means of notices in the *London Gazette*. From this information medical officers of health of areas containing customs aerodromes furnish the appropriate customs officer and person in charge of each aerodrome with a written list of infected places. In addition, each government has drawn up its own regulations regarding the sanitary control of aviation, and in this connection the Public Health (Aircraft) Regulations, 1938, issued by the Ministry of Health are designed to prevent the introduction of infectious diseases from abroad into the United Kingdom by aircraft, and are applicable to all aerodromes officially recognized for customs purposes for the arrival and departure of all foreign-going aircraft, which are not permitted to land elsewhere. In the case of a forced landing of an aircraft entering the country from abroad, the commander must notify the local authority, or customs or police officer, as soon as possible, and the crew, passengers and cargo must not leave or be removed from the vicinity of the landing-place until permitted to do so by the local authority; then the aircraft, if infected or arriving from an infected area, should proceed to a sanitary aerodrome; if the aircraft is unable to proceed, the passengers and crew may be allowed to continue their journey by other means, provided

that they have given their names and addresses of intended destination to the local authority, who forwards the information to the local authority of the intended destination in each instance.

Prior to dealing with the actual working of the International Sanitary

Authorized Aerodromes



Key :—

DR = Medical officer with examination room

C = Customs officer

Water = Wholesome water supply

Excreta = Safe disposal of excreta, refuse and waste water

S.I. = Sanitary Inspector

L = Laboratory or collecting facilities

+ = Isolation quarters

Dis = Disinfector and disinfestor

HP = Isolation hospital near aerodrome with appropriate transport

Rats = Adequate protection of aerodrome against rats

= Sanitary cordon

= Blockade

= Entry by aircraft

Natives to leeward ½ to 1 mile →

DIAGRAM I.—Diagrammatic representation of various types of authorized aerodromes: there is a gradual transition from one to the other in the order—customs aerodrome, sanitary aerodrome, local area and anti-amaryl aerodrome.

Convention for Aerial Navigation, it is convenient to consider the various types of authorized aerodrome. Aerodromes, on which aircraft legally may make their first landing on entering a country, or from which they may depart, are collectively termed "authorized aerodromes," and include customs, sanitary and anti-amaryl aerodromes, as well as certain local areas (*see* diagram I).

(i) *A customs aerodrome* must have an appointed medical officer on call as required, in addition to a customs officer. There must be a well-lighted room for medical inspections, together with a room for the temporary isolation of infectious cases, and separate lavatories for the two sexes. An assistant health officer or local facilities for disinfection and deratization are not necessities.

(ii) *A sanitary aerodrome* takes the health control a step further, as, in addition to the requirements of a customs aerodrome, there must be an organized medical service with one or more sanitary inspectors to supervise such duties as disinfection; equipment for taking and despatching material for laboratory examination, if the examination cannot be done on the aerodrome; facilities nearby for the isolation, transport, and care of infectious cases, as well as for the isolation of contacts, separately; apparatus for carrying out disinfection, disinsection and deratization; and an adequate supply of good drinking water, and safe disposal of excreta, refuse, and waste water. In addition, the aerodrome must be protected against rats.

(iii) *A sanitary aerodrome* may be designated a "*local area*" if it is so sited as to be beyond all probable risk of contamination from without; in addition, no one must enter or leave such an aerodrome except with the permission of the competent authority. If cholera, plague, smallpox, typhus, or yellow fever is present in the surrounding district, then, except for persons working on the aerodrome, no one is permitted to enter except by air.

(iv) In districts where yellow fever exists, either clinically or as proved by mouse-protection tests, preventive measures are taken still a step further, as an *anti-amaryl aerodrome* must, in addition to conforming to the requirements of a sanitary aerodrome in a local area, be situated at least a mile to the windward of habitations, especially those of natives; it must be kept free from yellow-fever-carrying mosquitoes, and provided with mosquito-proofed quarters for aerodrome staff, aeroplane crew and passengers; quarters for the last-named must be separate, as passengers may require surveillance for a period up to six days before embarkation to ensure freedom from yellow fever.

The Sanitary Control of Aerodromes.

In the case of aircraft arriving from abroad, if a death other than an accident occurs, or if there is a case or suspected case of infectious disease (other than tuberculosis or venereal disease) on board, the commander of the craft must notify the aerodrome medical officer or customs officer, preferably by wireless before arrival: if the person in charge of the aerodrome gets this information first, he must notify the medical officer and customs officer immediately.

Infected aircraft or those coming from places infected with cholera, plague, smallpox, typhus, or yellow fever, or those with rodents dying aboard, must not discharge passengers, crew, or cargo until after the medical officer has inspected them and declared them free from infection. The usual procedure is to isolate in hospital persons showing definite evidence of infection, while the contacts may be liberated (depending on the disease and the locality) after giving their names and addresses of destination, so that the appropriate local authorities are able to keep the contacts under surveillance during the incubation period of the disease. The customs officer is usually the first person to visit an aircraft on arrival

and, if it is infected or suspect, he orders its detention and forthwith notifies the medical officer and the person in charge of the aerodrome of the fact. If the medical officer does not inspect an aircraft within three hours it is free to leave, and, should he not consider it necessary to inspect any aircraft and passengers, he may give a liberation certificate in writing to the customs officer concerned. It should be noted that no mail can be detained, disinfected, or destroyed, except packages containing fish, shell-fish, fruit, or vegetables coming from a cholera-infected area.

In brief, the sanitary control of arriving aircraft is along the following lines:—

(i) Medical inspection of passengers and crew.

(ii) Isolation in hospital of infectious cases, other than tuberculosis or venereal disease.

(iii) Surveillance of contacts, usually at home, during the incubation period of the disease, after de-lousing in the case of typhus contacts, and ridding of fleas of plague contacts; adequate vaccination against smallpox or inoculation against cholera or yellow fever exempts from isolation.

(iv) Disinfection of aircraft and infected articles in cases of cholera, plague, smallpox and typhus.

(v) Disinfestation of aircraft and personal belongings in cases of plague and typhus.

(vi) Disinsection of aircraft in the tropics and subtropics to prevent yellow fever, dengue and malaria-infected mosquitoes from being introduced into the country.

(vii) Deratization of aircraft in case of plague or death of rodents on the voyage.

(viii) Proper disposal of excreta on arrival, as it is forbidden to discharge excreta from the air, except over the open sea.

(ix) The provision of a safe drinking-water supply, protected against mosquito breeding and, in the case of cholera, the water stored on board the aircraft must be disinfected and emptied out, then the tanks must be further disinfected before filling with wholesome drinking water.

(x) Prohibition of the unlading of fresh fish, shell-fish, fruit, and vegetables, if there is a case of cholera on board or if the aircraft has come from a cholera-infested area.

As regards departing aircraft, passengers and crew are medically examined, if necessary, especially in areas where cholera, plague, smallpox, typhus, and yellow fever are prevalent. The aerodrome medical officer may prevent any person, who shows evidence of suffering from an infectious disease, from travelling by aircraft. He may also stop the embarkation of close contacts of any of the infectious diseases mentioned above, unless such contacts have been successfully vaccinated against smallpox within three years, or inoculated against cholera recently or against yellow fever within two years,[1] and, in the case of typhus, disinfested if necessary. In

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[1] No definite period is stated for yellow fever, but the yellow-fever antibody content of the blood of those inoculated with virus vaccine is considered to be sufficiently high at the end of two years to ensure immunity in the majority of instances.

addition, he must ensure that no infected bedding, clothing, or articles, are taken on board, and that the aircraft itself is free from infection, e.g., freed of rats in a plague area or disinsected in a yellow-fever zone.

This leads to a consideration of the *journey log-book*, which all aircraft engaged on international flights must carry, and in which public health matters concerning aircraft and passengers must be entered. Such entries should include any sanitary action taken in regard to the aircraft at the port of departure or at places of call *en route*, as well as any health items that occur on the voyage, such as the presence in the aircraft of any person who requires surveillance. To facilitate the medical examination at the aerodrome of arrival an entry must be made if cholera, plague, smallpox, typhus, or yellow fever has occurred in the area of departure within fifteen days; in certain countries, especially in the yellow-fever zones of the Americas, a " Certificate of origin of passengers " is demanded as an additional aid.

One hiatus in the International Sanitary Convention for Aerial Navigation is the fact that it does not apply to Service aircraft of any nation. Thus, as far as we are concerned, unless the Royal Air Force falls into line with the principles and spirit of this Convention, preventable disease may be spread by air to civilians and Service personnel alike, especially by aircraft moving from one command to another in tropical and subtropical countries. The matter is now under consideration at the Air Ministry, and appropriate Service regulations will shortly be issued.

Yellow Fever and Aviation.

Yellow fever merits a section to itself, for special precautions have to be taken against this disease, as the mosquito vector (*Aëdes ægypti*) is so prevalent throughout the tropics and subtropics that, if the disease were introduced by means of a human case or by infected mosquitoes, a severe epidemic would result, especially as the infection would occur among highly susceptible peoples. In fact, the fear of this dread disease spreading to India by air traffic within the incubation period is so great that the Government of India has taken additional precautions to those laid down in the International Sanitary Convention for Aerial Navigation. Thus, passengers by aircraft from yellow-fever or suspected yellow-fever areas in Africa, are not permitted to enter India until nine days have elapsed since their departure from the affected area, and aircraft are not permitted to fly direct to India from such an area unless in possession of a certificate issued by the Egyptian Quarantine Board stating that the aircraft has been adequately disinsected. In common with the Dutch East Indies and the Sudan, India has prohibited the importation of yellow-fever virus, even for research purposes. As a further safeguard, India, Iraq, and Egypt have mutually agreed to inform each other by telegram of any air-passenger

coming from a dangerous area, while India further demands that a wireless message, stating the health condition of the aircraft, be sent to Karachi two hours before arrival.

That there has already been a recent spread of yellow fever from the endemic zones in West Africa eastwards is strongly suggested by Findlay's (1938) findings in the Malakal district of the Southern Sudan, for in 1933 only 1 per cent. of the population tested gave a positive yellow-fever response to the mouse-protection test, compared with 21 per cent. positive in 1938. As *A. ægypti* is present in this district, it is assumed that the infection is of the urban and not the jungle type. Recently, there was a fatal case of yellow-fever in a European, at Kouy, in the Sudan. It is evident, therefore, that yellow fever is occurring as far east as the Anglo-Egyptian Sudan, without classical symptoms, and only awaits suitable soil and exaltation of virus to produce a severe epidemic. Though this spread of yellow fever coincides with the opening up of the air-routes from West Africa to the Sudan, it cannot be affirmed that this has been the mode of spread of the infection, as motor traffic has also greatly developed at the same time, and anti-yellow-fever measures are more easily enforced in the case of aircraft than with motor-car traffic.

Nowadays, air-travel is so rapid that an aeroplane departing from the yellow-fever zones of West Africa reaches the Sudan in two days, Mozambique in four days, Durban in five days and, by another route, Karachi in five and Calcutta in six days, respectively; all these places are heavily infected with Aëdes. There is, therefore, great danger of yellow fever being spread by air-passengers incubating the disease or by infected mosquitoes in the aircraft, unless special precautions are taken. Anti-yellow fever precautions are carried out on the following lines:—

(i) The provision of anti-amaryl aerodromes.
(ii) A campaign against *Aëdes ægypti*.
(iii) Control or isolation of intended air-passengers in yellow-fever areas before embarkation.
(iv) Change of aircraft during journey to prevent direct transport of insects infected with yellow fever.
(v) Destruction of mosquitoes in aircraft.
(vi) Protective inoculation.

(i) It is desired to create *anti-amaryl aerodromes* in all yellow-fever and suspected yellow-fever districts; such aerodromes have been established at Kano and Malakal; Khartoum, being a junction and clearing place for air-traffic, is also an anti-amaryl aerodrome, though not situated in a yellow-fever district.

(ii) A *campaign of destruction* has been instituted against *A. ægypti* and other yellow-fever species, especially in anti-amaryl aerodromes and their vicinity. Since this campaign began the *A. ægypti* indices in many

places along the air-routes of Africa have markedly declined, especially in West Africa.

(iii) Intending passengers may be required by health authorities to go into *isolation*, if necessary, for six days before embarkation. In Nigeria, seven days' notice of proposed flight is demanded, so that it can be decided whether quarantine in a mosquito-proofed hut is necessary before embarkation.

(iv) A *change of aircraft* during journeys lessens the risk of missed, infected insects being transported beyond a certain point. Land 'planes operate between West Africa and Khartoum; here, other 'planes complete the journey to East or South Africa, or to Egypt, where another change is made at Alexandria before travelling on to India.

(v) The *destruction of mosquitoes in aircraft* has occupied the attention of many public health experts and aircraft constructors in various countries during recent years. Difficulties as regards the type of sprayer and insecticide to be used have had to be overcome. First, the ordinary "Flit" gun was used but proved of little practical value, as the spray produced was neither sufficiently fine nor penetrating. Pressure sprayers, driven by petrol engine or electric motor, were found suitable for aerodrome work but were too heavy and cumbersome for use actually during flight, which is the ideal method of disinfesting aircraft as it ensures destruction of insects before landing, as well as saving valuable time: disinfestation should be done just before or after taking-off and again from a quarter to half an hour before landing.

Park Ross, of South Africa, suggested building tracheal ducts into aircraft so that insecticide could be diffused through all internal compartments, but this idea was rejected, mainly on account of the great increase of weight involved. His visit to England in 1937, in connection with this matter, however, brought to light the Larmouth carbon dioxide sparklet method of diffusing insecticides under pressure in the form of a very fine spray, which could penetrate all corners of the compartment treated, even behind curtains; this result is attained by the pressure of carbon dioxide liberated by a sparklet bulb forcing the insecticide from a 50 c.c. metal container through fine copper tubing to jets in the compartment requiring to be treated. This year, an equally effective apparatus, the Phantomyst Nebulizer (made by André (Components) Ltd.) has been used for disinfesting aircraft; by means of this apparatus, which weighs only 17 lb. and can be easily transported from one compartment to another, a dry and penetrating mist is formed by compressed air forcing the insecticide through fine jets to atomize it, then on to high-speed rotors, where it is pulverized; the machine is calibrated to disperse 1 c.c. of insecticide a minute, and ten to fifteen minutes' action is required for a compartment of about 500 cubic feet. The sparklet ejector apparatus and the Phantomyst have been

widely experimented with by Imperial Airways, and for this purpose were fitted to their flying-boats *Cassiopeia* and *Cambria* on the Southampton-Durban run; the results have been most satisfactory. A full report of these researches has been published recently by Mackie and Crabtree (1938), who stressed the necessity of placing the disinfesting apparatus in different positions in the compartments, depending on the normal continuous but slow flow of air currents from behind-forward in the aircraft, due to aerodynamic forces exerted on the outside of the machine. In flying-boats the sparklet ejector apparatus has been found most suitable for freight compartments and the Phantomyst Nebulizer most suitable for passenger compartments.

The choice of suitable insecticides for aircraft work is of prime importance, for, as Mackie (1938) states, it should be: (*a*) Highly toxic to insects; (*b*) innocuous to passengers; (*c*) non-inflammable; (*d*) non-corrosive and non-staining; (*e*) stable in all climates and readily miscible with water.

Therefore, " Deskito," which is a water-soluble pyrethrum concentrate, requiring to be diluted ten to fourteen times its volume with water immediately before use, has been adopted by Imperial Airways; the dosages which have been found essential (acting for ten minutes) to kill all mosquitoes in aircraft are from 50 to 150 c.c. of 1 : 14 Deskito per 1,000 cubic feet of space for the ejector apparatus, depending on the parts of the aircraft to be treated, and 30 c.c. of 1 : 10 Deskito per 1,000 cubic feet for the Phantomyst Nebulizer. Professor J. W. Munro recommends a 1 : 30 dilution of Deskito in water, using 150 c.c. for each 1,000 cubic feet of space to be treated and allowing the insecticide to act for fifteen minutes.

Pyrocide 20 is another very effective insecticide and is used widely in America, Egypt, and India, but as it contains a paraffin base, which with repeated application gradually saturates the walls and furniture of the aircraft, it so increases the risk of fire that it is considered inadvisable to use it.

Recent investigations by the Pan-American Airways, reported on by Cumming (1938), suggest that the present method of disinfesting the interior of aircraft is inadequate, as infected mosquitoes and other insects can find safe harbourage in the space between the outer and inner linings of the aircraft, or in the hollow wings, and can thus be transported to other aerodromes or forced landing grounds. In addition, he states that the exterior of the aircraft offers many hiding places for mosquitoes and instances the space which accommodates the retracted under-carriage, various grooves in the structure, and innumerable rivet holes. It is felt, however, that air currents during flight will dislodge most of these insects, but should later experience confirm Cumming's views, steps will require to be taken to disinfect these remote spaces and crannies.

As regards the prevalence of insects in the cabins of aircraft, the incidence varies with the site of the aerodrome, especially whether it is on land or water, and, in the latter case, the distance from the shore; flying-boats usually moor well out at a floating pontoon. C. B. Symes found that of 52 aircraft arriving at Kisumu from the north, approximately 50 per cent. harboured insects, including culicine and anopheline mosquitoes, muscidæ, tabanidæ, and chironomidæ; the insect population in these aircraft would doubtless have been far greater, but for the antimosquito measures practised at aerodromes. From Kisumu south to Durban, the local authorities have taken the additional precaution of trying to limit the entrance and exit of insects by hanging overlapping curtains, impregnated with para-di-chlor-benzine, over the doorway of aircraft. It would appear advisable to fit these curtains on all aircraft travelling over yellow-fever districts, especially in view of the possibility of such aircraft using re-fuelling aerodromes, which are mere clearings in the jungle, placed a reasonable distance from human habitations, and supposed to be kept Aëdes-free. Incidentally, passengers are not permitted to embark at re-fuelling aerodromes without a special health certificate from the local medical officer of health.

(vi) *Protective inoculation with virus vaccine* has proved a most valuable preventive medicine measure against infection with yellow fever; protection begins about a week after inoculation and is fully developed in 90 per cent. of cases within three weeks, persists apparently for about two years, and is equally effective against urban and jungle types of the disease. Prior to 1937, the virus was given in conjunction with hyper-immune human serum with the result that, in about 3 per cent. of cases, infective hepatitis occurred three to four months after inoculation; at times the incidence was higher; thus, in Egypt, of 54 R.A.F. personnel inoculated against yellow fever with immune human serum plus attenuated viscerotropic virus, 7 men (i.e. 13 per cent.) developed jaundice three to four months later, whereas jaundice did not occur in any of the 996 R.A.F. personnel living under identical conditions, but not given this inoculation: the blood-sera of the jaundice cases following inoculation were tested and found to be free from yellow-fever-immune bodies in every instance. During the past fifteen months, however, an attenuated pantropic virus grown on chick embryo minus its central nervous system has been used: this virus has lost much of its viscerotropic and neurotropic properties, yet it produces a high degree of immunity to yellow fever; already 3,500 injections of it have been given in this country to people proceeding abroad and over 800,000 in Brazil, without the occurrence of a single case of jaundice. The assumption is, therefore, that the delayed hepatitis, which occurred previously after inoculation with certain batches of yellow-fever virus plus human immune serum, was due to the virus of infective hepatitis being present in some batches of human sera, analogous to the hepatitis, at times

fatal, which has followed inoculation with measles and encephalitis-immune sera (Findlay and MacCallum (1937) and Propert (1938)). This defect has now been overcome by using only sufficient human serum to suspend the virus, that is 0·25 c.c. at each inoculation instead of about 30 c.c. as previously. The protective power of this virus inoculation is manifested by the fact that there has not been a case of yellow fever among 5,700 Britishers so inoculated before going to yellow-fever zones, whereas during this period there have been 40 cases of yellow fever among Britishers who were not immunized; moreover, nowadays, yellow fever does not occur among research workers in this field, though before the introduction of protective inoculation many distinguished workers, including Noguchi, Stokes, and Young, contracted the disease and died.

It is a wise precaution, therefore, for all those who intend to travel by air through yellow-fever districts to be inoculated with attenuated pantropic virus, to give them protection against infection and to facilitate their journey, as those so protected are not held up in quarantine.

The practical points concerning anti-yellow-fever inoculation are :—

(*a*) The virus is issued solidified in ampoules, which should be kept in a refrigerator or on ice at about 4° C.

(*b*) When required for use, 1 c.c. of cold sterile water is added to the ampoule to dissolve the virus; the solution is complete in one minute.

(*c*) The inoculation needle must be cool and free of alcohol, otherwise the virus may be killed.

(*d*) The inoculation is given in the deltoid region at least fourteen days before the expected date of arrival in a yellow-fever zone.

(*e*) There may be a slight reaction about a week after the inoculation, the symptoms being headache, backache, lassitude, and low pyrexia (99° F.), which disappear in twenty-four hours and may be relieved with aspirin; there are no ill-effects such as jaundice.

(*f*) A certificate of inoculation should be given in each instance, as it may be required by the passenger on the journey.

(*g*) It is advisable to be reinoculated after a period of two years, if further exposure to infection is likely.

(*h*) In Aëdes-infected districts a mosquito-proof net may be kept around an inoculated person for three days after the inoculation, as the virus may be circulating in the blood, but this precaution is not essential as the amount of circulating virus is so minute and the virus itself so attenuated that it is unlikely to infect *Aëdes ægypti*.

(*i*) Persons performing inoculations should be immunized.

(*To be continued*).

REPORT ON THE THIRD INTERNATIONAL CONGRESS ON TROPICAL MEDICINE AND MALARIA, AMSTERDAM, 1938.

By Lieutenant-Colonel E. F. W. MACKENZIE, O.B.E., M.C.,
Royal Army Medical Corps.

(*Continued from page* 172).

Tsetse Fly.

Attempts at control of the tsetse fly by trapping with the Harris trap in Zululand over a period of more than two years were described in a paper by R. H. T. P. Harris, read by Professor P. J. du Toit, of South Africa. Very large numbers of flies were captured, and the records indicate an enormous decrease in fly density in the areas dealt with. An account was given of the phototrophic responses of the tsetses and the necessity for phototrophic stimulus in traps was urged. The Harris trap was described and the description will appear in the transactions of the Congress.

Professor J. Rodhan read a paper by Dr. L. van Hoof which dealt with tsetse-fly control in the Belgian Congo. The value of the Harris trap was confirmed. In the operations described this direct method of control was supplemented by indirect fly control by bush clearing. It was emphasized that the success of this method depends upon an exact knowledge of tsetse-biology and that different methods must be adopted in different localities.

The necessity for education and the co-operation of the native populations was drawn attention to. An organization for this purpose had been created, and the results already indicated that a considerable degree of success might be looked forward to. A point of interest was the contention that a high fly density is not necessary for the maintenance of endemicity.

Malaria.

It was possible for me to attend only isolated papers in this section. These are briefly reported upon as follows :—

Lieutenant-Colonel S. P. James discussed the validity of the various species and strains of the malaria parasites. After outlining the work carried out since 1925 for the purpose of testing the validity of *Plasmodium vivax*, *P. malariæ*, and *P. falciparum*, he advanced reasons why *P. ovale* may probably be considered a valid species.

This species, cultured in *A. maculipennis*, exhibits constant differences as regards oöcysts and sporozites. Wilson considers that the morphological characteristics of the parasite enable it to be distinguished from *vivax* even in a thick film.

Colonel James then dealt with the different strains or varieties which

exist within each species of malaria parasite. That these differ from one another in biological properties, and perhaps in some cases in morphological characters, is now generally accepted. Strains may be determined by their virulence, their reaction to drugs, or their antigenic properties.

Certain observations on immunity based on observation of induced cases followed.

The general conclusions were that acquired immunity gives no defence against a parasite of a different species ; some degree of immunity against different strains of the same species, and a high degree against the same strain.

Long date relapses were considered to be always due to interference with natural processes by treatment with drugs.

It has been shown that immunity could be conveyed to monkeys by large doses of highly immune serum.

Lieutenant-Colonel J. A. Sinton discussed the interference with the development of immunity caused by early treatment of a primary attack of malaria. A series of experiments in monkeys was described, the results of which suggest that following early intensive treatment little or no immunity is developed. With less intensive treatment, which permits a chronic infection to develop, a considerable degree of immunity is acquired, but infection allowed to resolve with no more treatment than is necessary to prevent death gives a much higher degree of immunity. The greater the degree of antigenic stimulus and the longer it persists the greater the resultant immunity.

Dr. A. A. Hulshoff, of Rotterdam, described the treatment of three cases of subtertian malaria with quinine-plasmoquine and three similar cases from the same ship with atebrin-plasmoquine. The results of the quinine treatment were superior both as regards relief of symptoms and freedom from relapse. A study of the records of the Harbour Hospital appeared to confirm this impression, and the author suggested that West African malaria, which constituted the majority of the cases, might not respond to atebrin as well as do other strains of *P. falciparum*.

In the discussion which followed, Sinton considered that Hulshoff had based his conclusions on insufficient evidence. Nevertheless, it is now found that different strains of the same species react in a different manner to the various drugs available. Sinton summed up this aspect of treatment in an admirably concise manner. An Indian strain of malignant tertian reacted rapidly to quinine ; an Italian strain of the same species did not, but reacted rapidly to atebrin. Attention was directed to the necessity for considering the patient as well as the parasite. Quinine may help the patient more, and it may be advisable to start with this drug and later to attack the parasite with atebrin. He emphasized that it is not possible to lay down a standard treatment for malaria, unless for a circumscribed locality, since the best treatment depends upon the strain and not upon the species of the parasite.

James emphasized that in attempting to study morphological differentiation of species, it is important to study the various strains in the same

animals of the same ages and state of health, since differences may arise as a result of altered environment.

Professor de Langen, in a free communication, drew attention to the tendency to assess the value of new drugs only by their influence on the malaria parasites. More attention should be paid to their pharmacological and toxicological effects upon the human body. In fact the patient should be considered as well as the parasite. He drew attention to the severe destruction of red cells which is caused by the malaria parasite, and emphasized the importance of ascertaining the effects of drugs upon the regeneration of hæmoglobin and red corpuscles. New medicaments are appearing in numbers, and our criteria are too often the statements of the manufacturers. Experience indicates that dangers from new drugs may not be fully realized until a period of six years or more after their introduction. He issued a warning against favourable reports on new drugs compiled on insufficient evidence and without due attention to possible disadvantages or dangers. He described various experiments carried out in an endeavour to ascertain the effects of various drugs on cell regeneration and sedimentation rate. The moral to be drawn from these is justification for their inclusion in some detail.

A patient suffering from severe anæmia was found to be taking atebrin. He was advised to stop taking drugs and recovered. It was thought that his condition had been due to delayed regeneration or hæmolysis of red cells caused by atebrin. The case was not so simple because it subsequently transpired that he had also been taking barbituric acid. A controlled animal experiment was therefore initiated. A hæmolytic anæmia was induced in groups of rabbits. Quinine was administered to one group and atebrin to another. When hæmolysis was stopped regeneration of hæmoglobin was the same, but cell regeneration was slower in the atebrin group. It might have been assumed that this was cause and effect, but an investigation into the histories of the rabbits revealed that the atebrin group had previously been used for tests involving the administration of barbituric acid. The investigation remains to be performed.

The Congress concluded on Friday, September 30, with a speech by the Chairman, Professor Dr. G. Grijns. This was followed by the closure of the Malaria Congress by Professor Dr. N. H. Swellengrebel, who regretted the very great difficulties which had been created by the atmosphere of unrest, both as regards changes of programmes necessitated by the premature departure of delegates and the preoccupation of mind which was inevitable in the circumstances.

Malaria Control in North Holland.

On Saturday, October 1, a tour of the malarial district of North Holland was made by those interested in malaria prevention. The party was accompanied by Professor Swellengrebel, who outlined the investigation into malaria in that district and the measures which were being taken as

the result of it. *A. maculipennis* is the only anopheline species found in Holland, but three varieties exist, the so-called longwings, shortwings, and *tropicus*. All are capable of carrying malaria, but *tropicus* exists so rarely as to be unimportant.

The investigation indicated that the first line of defence against malaria as it exists in North Holland to-day may be the destruction of adults by spraying selected houses during a very restricted autumn period only. That this may be so depends entirely upon the bionomics of the vector, which has been shown to be *A. maculipennis* var. *atroparvus*, locally called "shortwings." This variety breeds in large numbers only in brackish water. The success of spraying depends upon their habit of continuing to feed after the commencement of sexual inactivity, which has been termed "gonotrophic dissociation." This corresponds to the semi-hibernation of *Grassi*. It occurs between the end of July and early in September, and results in large numbers of shortwings resorting to human habitations and remaining there in permanent residence during the autumn and winter. During this period they are not stimulated by the reproductive urge to make long flights to breeding grounds, and they are thus in constant association with the inhabitants of the houses on whom they feed frequently. Given the presence of a healthy carrier in a house this fact makes it possible for them to be infected during the infrequent periods when gametocytes appear in the peripheral blood of healthy carriers who, since they display no symptoms, are not brought under medicinal control. While not embarking on long flights, these infected mosquitoes make short flights to neighbouring houses, and an infected house thus becomes a focus of infection.

Transmission in this manner can occur only after the cessation of the sexual activity of the shortwings, which takes place from the end of July onwards, and is therefore limited to the autumn. A further point of importance in the elucidation of the problem is found in Professor Swellengrebel's distinction between "house-borne" malaria which is conveyed by mosquitoes which do not merely visit houses but which stay there permanently, and "field-borne" malaria conveyed by mosquitoes which visit houses only to obtain the blood feeds necessary to sexual maturity, and which do not therefore remain for any length of time. The "long-winged" *A. maculipennis* belongs to the latter category and, since it practises true hibernation, cannot transmit malaria in the autumn. Field-borne malaria, which the longwings would be capable of propagating, plays no important role in causing malarial infection in Holland. This is practically confined to the autumn for several reasons, amongst which the following are important.

During the summer months mosquitoes may become infected in human habitations but remain there at the longest only until their ova are reaching maturity. They then depart on flights to the breeding grounds. Casualties are high, and those infected mosquitoes which survive this adventure become, on their return flights, susceptible to deviation from human habitations

by the superior attractions of animal houses. The vast majority, therefore, never return their infection to its true destination, the human blood-stream. Moreover, since all cases of clinical malaria are rapidly brought under medicinal control the principal reservoir of infection is the healthy carrier. The opportunity for mosquitoes to become infected during short visits to houses during their sexually active period is slight compared with the more or less permanent residence of the autumn shortwings in a state of gonotrophic dissociation. Longwings do not exhibit this phenomenon and cannot, for this reason, maintain infection in the existing conditions.

Malaria control by means of drugs brought the incidence of the disease to a lower level than existed before their use became general, but there it stopped, since the reservoir of infection remained in the figure of the healthy or comparatively healthy carrier, who does not recognize the disease and so does not submit himself for treatment. He thus continues to infect the mosquitoes which resort permanently to his house on the cessation of sexual activity.

It has also been found that the period after infection before sporozoites appear in the salivary glands of the mosquito varies from fourteen days in August to a month by the end of October. Sexual activity ceases at the beginning of August, and few anophelines enter houses after September 15. Even were this not the case the fact that sporozoites found in the salivary glands of mosquitoes after November are for the most part degenerated, limits the transference of infection to the autumn months. Spraying is therefore carried out once in August and twice in September and, under certain circumstances only, in October also. As stated above, only certain houses are considered to be foci of infection, and it is felt that it should be sufficient to limit the spraying to these houses. This greatly reduces the cost.

The results of this campaign suggest that, in the circumstances which exist, the destruction of adult shortwings by spraying in the manner in which it is carried out greatly reduces malaria in the succeeding year. It is, nevertheless, considered to be only a step on the road to complete control, which will ultimately depend upon the freshening of the water in North Holland, with consequent diminution in the number of shortwings. This, it is hoped, may result from the complete enclosure of the Zuyder Zee, now the Yselmeer.

It should be emphasized that the success of spraying has depended entirely upon the habits of the shortwings. Had it been possible for mosquitoes of other habits to be the vectors, infection would have been confined to visits to houses for blood feeds during the period of sexual activity, and the infected mosquitoes would therefore have departed from the houses in search of breeding grounds before their destruction was possible. In these circumstances spraying on a scale on which it is practicable to carry it out would fail completely.

For various reasons, including the difficulty of obtaining an efficient

larvicide that involved no risk of taste in the milk of cattle which might drink water containing it, attempts at larval control had previously failed.

The method of spraying is of interest. The apparatus, which is carried on a hand cart, consists of a cylinder of compressed air which is connected to a " blower " by rubber tubing of sufficient length to allow the blower to reach remote parts of houses. The relatively high pressure from the cylinder causes the emission of a powerful stream of finely atomized insecticide which has a penetration impossible of achievement by means of hand sprays. The insecticide used is the commonly employed pyrethrum extract and white kerosene oil.

This investigation stresses the fact, so often ignored, that the application of specialized measures to routine malaria control will, in all probability, be worthless unless preceded by a complete investigation of local conditions.

Before closing this report, acknowledgement is due to our hosts for the excellent arrangements which were made for the convenience of delegates, and for the very real kindness and hospitality which were extended both to the delegates and to the ladies who accompanied them as associate members of the Congress.

DIFFICULTIES ASSOCIATED WITH THE BACTERIOLOGICAL DIAGNOSIS OF BACILLARY DYSENTERY.

By Major ALBERT SACHS, M.D., M.Sc.
Royal Army Medical Corps.

During the past two years an investigation has been made into the possible causes which might be responsible for the failure to isolate the pathogenic causative organism from fresh specimens of typical bacillary dysentery exudates and from specimens sent in glycerine saline solution.

The investigation was divided into four parts :—

I.—To find the reason for failure to isolate organisms from fresh specimens of fæces from typical bacillary dysentery cases.

II.—(*a*) To decide whether the glycerine saline solution as generally prepared in military hospitals in this district is suitable, as the number of dysentery bacilli isolated from specimens sent in glycerine saline has been so poor.

(*b*) If this glycerine saline solution is unsatisfactory can a more suitable solution be prepared ?

III.—To find out whether any other factors might influence the isolation of organisms from specimens sent in glycerine saline solution.

IV.—To find out whether any improvement is necessary in laboratory technique.

The object of this paper is to record the findings in the hope that these may be of assistance to other laboratory workers.

I.—*To find the reason for failing to isolate organisms from fresh specimens of fæces from typical bacillary dysentery cases.*

It is well known that to obtain the best results specimens should be sent to the laboratory within the shortest possible time.

In Quetta it has been found that with a delay of more than one hour before the average fresh specimen is examined the chances of isolation are reduced, and beyond two hours they become remote. An average specimen is one which consists of fluid fæcal material containing blood and shreds of mucus. Most specimens are of this type. Specimens containing much blood and mucus can be kept up to three hours, with reasonable prospects of isolating the causative organism.

It is this delay in sending specimens that is mainly responsible for failure to isolate pathogenic organisms from fresh specimens of fæces. In order to overcome this, instructions have been issued that when it is impossible for fresh specimens to be examined within two hours, they should be placed as soon as possible in glycerine saline solution.

II.—(*a*) *To decide whether the glycerine saline solution as generally prepared in military hospitals in this district is suitable, as the number of dysentery bacilli isolated from specimens sent in glycerine saline is so poor.*

(*a*) All textbooks and regulations stress the necessity for using a "neutral" solution, but no details are given as to how this should be prepared. The usual method adopted in hospitals is to prepare a 30 per cent glycerine in 0·5 per cent saline solution and neutralize with dilute NaOH, testing the reaction with litmus paper.

The following observations have been made: (i) The reaction of different batches of glycerine as received from Medical Store Depots was found to vary considerably. (ii) When glycerine saline solution was prepared in bulk and neutralized by the addition of N/10 NaOH and then fractionally sterilized by steam, the reaction changed to acid within twenty-four hours. It was therefore not surprising that glycerine saline solution containing mucus received from out-stations was invariably found to be acid.

From the above observations it is clear that the method of preparing a neutral glycerine saline solution is unsatisfactory and was probably the chief reason why indifferent results have been obtained.

(*b*) *If the glycerine saline solution is unsatisfactory can a more suitable solution be prepared?*

An attempt was made to produce a stable neutral glycerine saline solution. After several experiments it was found that a stable buffered solution could be prepared by adding di-sodium phosphate and using phenol red as an indicator. Buffered glycerine saline prepared by this method and stored in one ounce screw capped bottles retained its reaction for two years. The method now used for preparing the buffered glycerine saline solution is as follows:—

Requirements:—

Glycerine	1,000 c.c.
0·85 per cent saline solution	2,000 c.c.
Saturated aqueous solution of phenol red in 5 per cent solution of Na_2HPO_4	

Method of Preparation.

(1) To 1,000 cubic centimetres glycerine add 2,000 cubic centimetres saline solution.

(2) To this mixture add sufficient phenol red solution to match the standard indicator (phenol red) tubes in the pH set.

(3) Add sufficient Na_2HPO_4 solution to adjust reaction to pH 8·0.

(4) Tube off in 10 cubic centimetres bulks in one ounce screw capped bottles.

(5) Sterilize either fractionally or for ten minutes in the autoclave at ten pounds pressure.

The reaction after sterilization will be about pH 7·4.

That the new buffered glycerine saline solution is suitable is shown by the findings obtained after two years use. These are summarized below.

Screw capped bottles containing buffered glycerine saline were first issued

to the Medical Officer in charge of the Staff College and the Staff Surgeon during the dysentery season 1937. The results obtained from specimens sent in by these medical officers proved so encouraging that the use of the bottles was extended to local hospitals for collecting specimens from dysentery cases when the laboratory was closed. The causative organisms were isolated from 85 per cent of specimens received in these bottles.

During 1938 all military hospitals in Baluchistan and Zhob received from the laboratory a supply of one ounce screw capped bottles containing buffered glycerine saline solution. All specimens from suspected and proved cases of dysentery, enteric fever and cholera were sent in this solution.

The number of isolations from specimens sent in from out stations greatly improved. A great increase in the isolation of organisms belonging to the enteric group also occurred. This was an unexpected finding, and it may well be that unsuitable glycerine saline solution in the past was responsible for the poor isolations from enteric fever cases. The cholera vibrio was isolated from four out of five specimens of clinical cholera sent in from an outstation.

III.—*To find out whether any other factors might influence the isolation of organisms from specimens sent in glycerine saline solution.*

The points particularly investigated were the following :—

(*a*) The best type of specimen to send to the laboratory for examination.

(*b*) The most suitable method for selecting specimens and the most useful container.

(*a*) Experiments have shown that it is essential to have mucus as free from fæcal material as possible. From observations made, it appears that apart from any overgrowth of coliform organisms the actual contact of the mucus with fæcal material often precludes the isolation of the causative organism from typical bacillary dysentery stools. The fæcal material appears to contain some *inhibitory* substance.

This observation is of importance on account of the long time taken for specimens from outstations to arrive at laboratories. It has been observed that a higher percentage of dysentery bacilli is isolated from specimens in glycerine saline solution containing chiefly mucus, than from those containing in addition much fæcal material. As an experiment, selected pieces of mucus washed in saline were placed in the buffered glycerine saline solution. The causative organism could repeatedly be isolated after an interval of seven to ten days from these specimens, which had been kept at room temperature.

(*b*) The most suitable method for selecting specimens, and the most useful container : It sometimes happens that on examination in the laboratory no mucus is found in specimens sent in glycerine saline solution and taken from dysentery cases that had a definite bacillary exudate. This is due to carelessness in selecting the specimen sent for examination. This would be

avoided if at the same time that mucus is being selected for examination in the hospital clinical side room, some shreds could be "fished out" and put in the screw-capped bottles, instead of a quantity of fæces which may or may not contain mucus.

The use of screw-capped bottles containing glycerine saline solution has many advantages over the fæces-container issued. The chief disadvantage of the fæces-container was that after being in use a few times it invariably leaked. Another objection is that the scoop fitted into the cork stopper, while being excellent for scooping quantities of fæces, which is necessary in cases of enteric, is unsuitable for "fishing out" shreds of mucus.

It has been found that a very satisfactory loop for selecting mucus can be made from any thin pliable wire twelve inches long. One end of this wire is fashioned into a loop, the point protruding to help entangle the mucus. These were issued to some medical officers in the same manner as throat swabs. Hospitals could easily prepare several and sterilize them by flaming, but not by disinfectants.

IV.—*To find out whether any improvement is necessary in laboratory technique.*

It was found necessary to pay particular attention to the following points :

(*a*) Preliminary treatment of the mucus prior to plating.

(*b*) Standardization of the method for preparation of bulk supplies of litmus lactose bile salt agar.

(*a*) Preliminary treatment of the mucus prior to plating. Careful attention must be paid to the actual washing of the mucus before plating. The use of watch glasses for this purpose is not recommended.

A special double rack has been made to hold sixteen 7/8 by 2 inch sterile test tubes in two rows. Each row is numbered to avoid mixing the specimens. All the tubes are filled with one inch of sterile saline.

The use of sterile tubes and saline is stressed, since on more than one occasion non-lactose fermenting organisms have been recovered from clean tubes containing non-sterile saline.

The selected mucus is placed in one tube, thoroughly washed, and then transferred to a tube in the second row and washed again. By this method the washing of the mucus is more effectively controlled than when using watch glasses. Two plates of litmus lactose bile salt agar are inoculated from each specimen.

(*b*) Standardized method for the preparation of bulk supplies of litmus lactose bile salt agar. Sufficient media is prepared at one time for 1,000 plates. During the summer months the average number of plates in daily use is about 120. The method of preparation that has been most satisfactory is detailed below :—

Agar fibre	2·5 per cent
Peptone	2·0 ,,
Sodium taurocholate	0·5 ,,
Lab-Lemco	0·5 ,,
Sodium chloride	0.5 ,,
Tap water	Q.S.

Dissolve in an autoclave and adjust reaction to pH 7·4 using a pH set with phenol red indicator and N/10 NaOH.

Separate the media into 500 cubic centimetres or other convenient bulks in screw-capped 20-ounce size bottles and then steam them. Decant or pour off the clear medium and sterilize by fractional sterilization. This is the stock medium for use. When required add 2 per cent lactose to the stock medium and melt. To the melted agar add sufficient sterile litmus solution to give a good blue colour, shake well, and then pour plates.

By this method satisfactory blue plates are easily prepared. If litmus solution is added earlier during preparation of the medium it is apt to lose colour, and give the plates a dirty reddish brown appearance. By decanting or pouring off the clear medium, eggs are dispensed with for clearing and a lengthy filtering process is avoided.

The surface of the plates should be dry before use.

Summary.

(1) It has been found that neutral glycerine saline solution as prepared in military hospitals in this district is unsuitable.

(2) The preparation of a buffered glycerine saline solution containing an indicator is described. There has been an increase in the isolation of organisms belonging to the enteric, dysentery and cholera groups from specimens sent in this solution from outstations. The solution has the advantage of being stable and the presence of an indicator acts as a check on the suitability of the solution.

(3) The undermentioned points relevant to specimens of fæces from dysentery cases have been discussed. (*a*) The age of fresh specimens; (*b*) The best type of specimen to be sent to the laboratory; (*c*) The most suitable method for selecting specimens.

(4) Details of some improved methods of laboratory technique are given.

Dr. JAMES BARRY: INSPECTOR-GENERAL OF THE ARMY MEDICAL DEPARTMENT.

By Colonel N. J. C. RUTHERFORD, D.S.O.

(*Continued from page* 178).

In 1903 the writer, stationed at the Cape, was placed under orders for service at St. Helena, which was part of the Cape Command. But in Barry's time St. Helena was flourishing as the stopping place for our immense Eastern Trade Route traffic round the Cape, and of great military and naval importance.

Barry would have been a Surgeon-Major on the medical staff of the Island.

In 1903, if I had gone to St. Helena I, as a captain in the R.A.M.C., would have been the only medical officer, the garrison consisting of a company of garrison gunners, some engineers and ordnance personnel, and when I last saw the Island in 1932 the total military population was said to be some twenty gunners looking after the barracks. But until the Suez Canal came into action in 1870 the great Indian and Eastern sea traffic used St. Helena as a port of call. So one can imagine Barry as one of a fairly large garrison. How she lived at St. Helena and how long she remained, does not seem to be known. Perhaps she just did a short turn of duty from the Cape on her way home *en route* for Georgetown in British Guiana, where the active little figure of Barry again appears.

The troops were stationed in Eve Leary Barracks, and Barry was the principal medical officer of the station, known to all as the P.M.O. Age had made great changes in the debonair red-headed little surgeon. Service in malarial stations had taken their toll, and Barry was now a yellow-complexioned cadaverous little person, thin-faced and snappy mannered. The importance of his position made him pompous and overbearing towards his inferiors. Among the medical officers serving under him Barry was known as a hard man to please and one who would brook no slackness in duty or deportment.

Do we see here the feminine capacity to rule and command being exercised in secret pleasure by Barry over these mere men who found themselves unwittingly under the command of a middle-aged lady ?

Another change in Barry also points the way of her declining years and the passing interest in personal appearance. From being almost a dandy in dress and appearance, we are shocked to find him described as "old and peevish, dressed in nankeen blouse and trousers, hanging loosely on his emaciated small frame."

An officer arriving at the barracks meets the P.M.O. and notes how he

spoke "in a sharp, crabbed tone that repulsed cordiality," and how he took the first opportunity to get away, "keeping his sharp grey eyes fixed on his small feet as he walked quickly as if to get away from the society of a fresh acquaintance."

The P.M.O. is discussed in the Mess and the Colonel of the 3rd West India Regiment describes him as "an oddity, but don't mind his peevish ways. A right good fellow at heart and an excellent physician." Further talk elicited the statement that Barry had plenty of interest, could choose his own stations, and always selected one far from home and, if possible, a lively, social place where women were plenty and life afforded opportunities for flirtatious moments.

Why a woman should engage herself in "flirting" with members of her own sex is difficult to follow, but no doubt Barry extracted a good deal of amusement in watching the jealous husbands and lovers becoming infuriated at the antics of the shrivelled little doctor. It does not seem to have precipated another duel as far as we know, so may-hap the older Barry only elicited the laughter of younger men at the amorous excursions of the middle-aged.

The ladies of the garrison had great respect and liking for the P.M.O., firstly because he was proficient in his profession and insisted that his subordinates should be so also; never would he put up with slackness or delay in attending to the sick soldiers or their families, and woe betide any medical officer who got himself into trouble. Barry would break him on the spot, pack him off to England with a scathing confidential report, enough to damn all future prospects in the medical service.

The P.M.O. did not confine his martinet manners to his own medical subordinates. But if the need arose, he never missed asserting his superior rank should any of his combatant brother officers give him cause for complaint.

Part of his duty was to inspect stations up country garrisoned by the West India soldiers and such inspections were generally carried out by a combined naval and military expedition, the Royal Navy providing a small gunboat to carry the inspecting military officers.

At one such inspection, the other officers arrived at the docks late and found Barry on board and extremely caustic on their dilatory methods.

"You call this military punctuality, I suppose? I had a very strong notion of going off myself and ordering the captain to proceed. The hour of embarkation appeared in orders as 5.55 p.m., and it is now actually 6.10 p.m. I shall certainly report you gentlemen to the Colonel. He could scarcely have intended that I should have to await the convenience of junior officers!"

But the said young officers have the temerity to argue that as they are going to assist at a Court Martial the importance of their duties exceeds that of holding a mere medical inspection and that the P.M.O. would not have dared to set off without them. This impertinence drives Barry into

a sulky silence which he utilizes in ostentatiously reading certain heavily crested home letters just arrived by the mail boat. No sooner has the boat reached the gunboat than Barry, enforcing his seniority, is the first to step on the deck. He at once demands an interview with the Captain, and is escorted to the Captain's cabin. The naval officer does not know what to make of this odd little man. Firstly, Dr. Barry inquires anxiously if his private goat has arrived on board ?

"Why, yes," replied the Captain. "I can confirm the arrival of the goat, and a d——d nuisance it will be on board. Why in Heaven's name do you want a goat on your travels ? I see also you bring your dog with you."

"Certainly," replies Barry, in a haughty and querulous tone. "I never move without my dog to keep me company, and my goat to supply me with milk. I trust you are well supplied with vegetables, as I am a strict vegetarian ?"

"Well, doctor, we will do our best, though I imagine the vegetarian diet will be a bit strange to the ship's cook. But we will manage, never fear. At any rate I can promise the liquor will be all right !"

"I have no use for abominable alcohol, sir. A wholesome vegetarian diet is good enough for myself, my dog, and my goat, but what I do want is the use of a separate cabin. To be placed in the same cabin with another would be abhorrent to one of my delicate sensibilities."

"Oh, come, doctor. What can you expect in a gunboat ? We shall all have to double up so as to fix you fellows in. Surely you wouldn't object to a bed-fellow ?"

"Object, sir ! I object most strongly. My seniority in rank demands privacy, and if I do not get it I shall order you to place me ashore at once ; the matter will at once be reported to the Governor."

Barry had played his old game of getting into intimate relations with the Governor, gaining the complete confidence of the Governor's wife by the certainty and skill of his medical and surgical knowledge, and establishing himself as a person of undoubtedly aristocratic family with powerful backing at home. As usual he gained his point, and was allotted the Captain's day cabin, in reality the Captain's office, where he carried out his daily correspondence and routine duties.

The little dog Barry carried about was trained to resent the entrance to Barry's bedroom on shore of any stranger and would be just as truculent in a ship's cabin.

As soon as dinner was over, Barry left the wardroom and retired to his cabin. The remaining officers sat over their port, and the naval officers expressed curiosity to hear something about this, to them, queer little man.

"What manner of animalcule is your doctor ?" asked the Captain. "We have heard strange rumours up and down the coast of the doctor. I can't call him a man ; he has neither the voice nor thews of one, and as for his height, he would be nothing without his heels. Did anyone ever see

higher ones and such a rigout generally, his big gingham umbrella included ? Does anyone know his history ? "

The military officer present replied : " All I know about him is what our surgeon says. He served under the fellow in the Mediterranean fifteen or sixteen years ago. Barry has all the makings of a tyrant and bullies his subordinates. One surgeon wanted particularly to come on this trip but the P.M.O. wouldn't hear of it, and instead ordered him to prepare a tiresome Annual Sanitary Report, and to have it all ready for his return."

Another military officer, evidently having no love for Barry, described him as " a conceited old fop, who, like most little creatures, desires to make up for his small dimensions by self importance." " However," he continued, " no one disputes his abilities as a surgeon and physician. He has performed some capital operations since his arrival and is constantly called into consultation by the Colonial surgeons in cases of malaria. Then again, the Governor always sends for the P.M.O. in any emergency in his family."

But now an officer who had definite knowledge of Barry's former life said : " I am the only man in a position to trace Barry's antecedents as far as they are known. One of my uncles on my mother's side left all his property to Barry's sister. That sister died. Some years after, a cousin of mine on the medical staff met Barry at the Cape, but Barry never discussed family affairs with him. The story goes that Barry asked my cousin to attend him at a duel twenty-five years ago at the Cape, when a bumptious young aide-de-camp had insulted him. Shots were exchanged, and Barry stumbled and fell, but he denied having been touched. The combatants shook hands and parted. Barry then confessed he had been hit and was bleeding. He would not allow my cousin to see the wound or dress it and made him promise to be secret over the matter. He staggered off to his room and locked himself in. In a few days he was up and about again, but from that moment he avoided my cousin in every way, and snubbed him on duty.

" Barry was promoted Surgeon on the Staff over my cousin's head, though the former had done not a day's Regimental duty. My cousin declared it was done by back-stairs influence at Whitehall.

" My cousin described Barry as repellent in manner and bombastic in speech, but that he played his cards well with the Government circle and ignored the Garrison set. The money he had inherited from my uncle gave him unlimited credit in the Colony and powerful letters of introduction placed him at the top of the tree in society. One day Barry went too far in his rudeness to my cousin, who promptly called him out. Barry refused the challenge, neither would he apologise. This fact coming to official notice, a Court of Inquiry sent him to England under arrest. Everyone thought his career in the Army was finished, but instead, he was transferred to a better station and now, as you see, he is at the top of his branch of the Army out here, and will go higher, they say."

The matter was closely discussed at table ; the naval captain was of opinion the P.M.O. was no coward and refused to fight with a relation of the man who had left him his money.

But after all this he continued, " Who *is* he ? Who was his father ? Has he no relations ? "

The same military officer replied : " I don't know. The man is reticent enough to provoke our curiosity without satisfying it, and clever enough to tangle the web without giving a clue. He boasts of his aristocratic connexions, of being the last of a noble line, and he assures us that the blood of princes flows in his veins. He prates of his lineage, that the Countess of X lives for his society, insinuates a Maid of Honour at Court resigned because Her Majesty refused to make him a K.C.B. He is amusingly eccentric—pomposity personified—but a gentleman every inch. His attention to the men's wives and families is worthy of all praise. Blear-eyed dissolute creatures as many of them are, he lectures them on health matters, particularly the eyes. He carries a pinch of tea in his waistcoat pocket and shows them how to soak a rag in a decoction of tea. He will say, " You must lie down, my dears, just like this (and he lies flat), and place a bit of tea-soaked rag over each eye, thus ; and you must remain in this position for half an hour every night for fourteen days."

" There on the floor lies the P.M.O., giving the grinning women explicit directions. And his fondness for puling infants is extraordinary ; he handles them as expertly as a monthly nurse. But then he delights in whipping off a man's arm or leg. He is a mystery."

The sitting broke up on this note, and all the officers retired for the night. Alone amongst them only the captain of the ship and the P.M.O. had their private cabins. And at the foot of Barry's cot lay the truculent little terrier, ready to spring up in defence should anyone dare to enter the cabin.

On arrival at the station to be inspected the P.M.O. stamped on deck in full regalia ; a large plumed cocked hat shrouded his shrunken features, a tunic that seemed to bury his small frame out of sight ; a big sword rattled in a brass scabbard ; brass spurs affixed to his two-inch heels, and to crown all he holds in his hand a huge umbrella !

The appearance on deck of this strange figure caused laughter and merriment, though the officers attempted to stifle their mirth. The incensed P.M.O. advanced upon them.

" I do not understand this merriment, gentlemen," he said haughtily. " I should have thought I had endured enough discomfort on board this ship without being insulted at daylight. Have done, gentlemen ! " His voice rose to a scream. " Have done, I say, or I place you all under arrest."

On shore at New Amsterdam waited the local medical officer to receive the dreaded P.M.O.

Immediately on landing the barracks and hospital were inspected. During his tour of the former, Barry was meticulous in every detail. On visiting the barrack rooms he demanded to be shown exactly how the men were clothed, the system of washing, repairing and issue of shirts and socks, the condition of blankets and arrangments for their washing and disinfection, the sanitary arrangements, the cleaning of barrack-room floors, how the

food was conveyed from the cook-houses, and every possible item that might affect the comfort and health of the troops. Needless to say, this strict inspection delighted the soldiers who saw their company officers and the Quartermaster strictly questioned and criticized by this peppery little man in the funny uniform. Hurried messages were despatched for the Commanding Officer who had not considered the inspection of a mere medical officer important enough to demand his presence.

On arrival he was at first astonished and amused at the quaint personality of this little man, but he soon recognized he had to deal with, to him, an unknown type. The P.M.O. showed an intimate knowledge of how barracks should be organized, and an uncanny familiarity with every regulation dealing with what the soldier ought to be supplied with down to the last one-thirty-sixth of an ounce of pepper in the daily ration. The fierce old Quartermaster had been reduced to a trembling condition of nerves by the stream of questions and demands fired at him, and the Captain had been reduced to mumbles of, "I am afraid I don't know, sir," when questions of the interior economy of the regiment got beyond their knowledge. The Commanding Officer was coldly received, and at once informed that the condition of the regiment left much to be desired and it would be the duty of the P.M.O. so to report when he returned to Headquarters.

So in a flurry of outraged feelings on both sides the P.M.O. clattered off in his spurs to rend the poor medical officer at the hospital. The Colonel was heard to exclaim: "Why, the fellow was more like the housekeeper of a country house berating idle servants than a d——d doctor coming into my barracks."

At the hospital he was a quite different P.M.O. His professional interest was now on top and once he had realized that all was clean and well organized he dived deeply into each case and showed his intimate knowledge and experience of tropical diseases. In the end, the inspection became a lecture to the medical officer and left the latter with the greatest respect and admiration for his chief.

On the voyage back to Georgetown the P.M.O. was a different person. He was genial, amusing, and kept the whole company in thrall with his witty and chatty stories of his experiences in different parts of the world. At times he launched out into descriptions of his visits to an uncle, the late Lord Malinmore, at his estate in Scotland, and the great people he met at the house. Mostly he dwelt on the eccentric habits of his distinguished relation, and freely admitted that, as a family, all the members of it were inclined to be somewhat eccentric and he himself was no exception. All the while cheerfully eating his vegetable dinner and sipping his goat's milk.

He left the ship as much an enigma as when he embarked and for long after the naval officers talked about the quaint little doctor and his odd, shrill voice and dainty feminine ways.

Back in Georgetown Barry resumed his intimacy with the Governor, Sir Henry Dopping, and was a constant guest at Government House. The

ladies of the colony were as puzzled at Barry as had been the ladies at the Cape. He had a whimsical way of treating them that raised their intense curiosity and he displayed an uncanny knowledge of the feminine ailments of body and mind. In an age when the male laughed and ridiculed the swooning and weeping habits of the fair sex, Barry seemed to be able to understand exactly how the dear ladies felt and was so full of sympathetic understanding that several of them were inclined to think themselves in love with this tender-hearted physician. So much so that when the doctor warned them off by suddenly turning cold and irresponsive, love turned to hate, and some would describe him as " that poor, whimsical, insignificant creature," and talk of him as " the pet of certain influential circles sought for his so-called social attainments."

But all " tittle-tattle " was hushed when the Europeans were attacked by a violent fever, resembling malaria but probably yellow fever, imported into America from the West Coast of Africa. The West Indian regiments did service in Sierra Leone, and in all probability carried the infection with them. Many of the garrison were stricken, and all people walked in fear of " Yellow Jack," as it was called, on account of the victims turning yellow with jaundice.

The P.M.O. worked himself to the bone and was indefatigable in visiting and treating all classes of patients. The ladies of the garrison were almost impatient because Barry would give as much attention to a black nigger or his " mammy " as he would to the Governor's lady. The little man was reduced to skin and bone but he never gave in, and became intensely irritated when kind female friends desired him to go to bed and let them nurse him back to strength!

Soon after the epidemic came to an end the P.M.O. commenced to show that recklessness that generally ended in a change of scene for him. He spoke openly of Georgetown having become " odious to him." He acidly disparaged the ladies and described them as being " curdy and wanting in any rose and honeysuckle freshness." At last he spoke openly at Mess of his intention to leave Georgetown and return to England.

" But how can you do that ? " he was asked. " Do you mean to exchange with another officer at home ? "

" Not at all," he replied. " It will not be the first time I have presumed to burst the bonds of regulations. The last time I did so I turned up at the office of the Director-General of the Army Medical Service and reported my arrival in England. The Director-General was quite annoyed and asked me in an angry tone, " What the devil brings you here, sir ? " I replied, " To get my hair cut," saucily enough I must confess, but he riled me with his arrogant airs. As soon as he gathered who he was dealing with he passed it off as a joke, saying with reference to my somewhat lengthy locks. " So it would seem, sir. And your audacity is of equal prodigious growth."

True to his word the P.M.O. calmly booked his passage, said farewell to the Governor and the Officer Commanding the Garrison, and sailed for

England. How he got away with a proceeding that was tantamount to open deliberate desertion, history does not relate. He should have forfeited his commission, but apparently he did not do so.

Here ends any available record of James Barry. What happened later until the time he was placed on half-pay on July 19, 1859, nobody of that time has mentioned.

The Dictionary of National Biography states that James Barry died in London at 14, Margaret Street, on July 25, 1865. The official report sent to the Horse Guards said that Barry was a woman. She died in lodgings, and neither the landlady nor her black servant who had waited upon her for years had any suspicion that she was not a man, an officer of the Army on half-pay.

Can we picture the scene of that lonely figure, a woman of 70 years of age, passing away attended by the faithful black servant she had brought from the Cape, and the perhaps scanty ministrations, if any, of the landlady or some "Mrs. Gamp" of the period, a creature who would not be likely to explore the anatomy of the patient by any undue washing operations; the sort of nurse who put the gin bottle on the mantelpiece and placed her lips to it when "she was so disposed."

I can imagine a Dickens picture of the dark old panelled room with the shrunken figure on the bed behind the drawn curtains. The blousy nurse crouching over the fire nodding asleep from an excess of liquid refreshment. The black servant wandering about the dim passage where he had been driven by the nurse who "could not abide a black savage in the same room." Down in the basement the landlady attending to her own affairs and the meals of the other lodgers. The rattle of cabs and carts over the cobbles in the street. The failing brain of the dying Inspector-General passing rapidly in review flashes of memory of the sunlit, tree-bordered streets of Cape Town, the sweep of the gardens of Government House under the slopes of Table Mountain, the glittering official dinner parties where he was an honoured guest of his friend Lord Charles Somerset. The wide, stone-flagged stoep of Alphen where he faced Captain Cloete, pistol in hand, and the sting of the bullet in his thigh that at all costs he must conceal from prying eyes and fingers lest the secret of his then young life be exposed. St. Helena, and the "Man of Destiny" sitting outside Longwood House in a straw hat and nankeen trousers. Georgetown, and the sweltering heat and tropical forests. What did not pass through that fading brain? Peoples and places we know not of, figures of his youth, his mother! his father! Belted earl for a grandfather, or humble Scotch folk for ancestors? Who knows what the secret of that strange life was. Soon Mrs. Gamp will nod herself awake, and stumble over to the bed to see why the patient is so quiet. Even her professional attainments can recognize death, and she places the sheet over the still face and calls in the black servant to announce that "The poor, dear gentleman has passed away that quiet she hardly noticed his going." The grief of the black man combined with his fear of death and

reluctance to approach the shape on the bed. The landlady notified and none too pleased at the news. "Upsetting a decent woman's house and making the lodgers uncomfortable. Why can't these old people be took away to hospitals to die." Mrs. Gamp left to her gruesome task of "preparing the body," and then the discovery of the true sex of the dead. The chatter and excitement. Mrs. Gamp springs into prominence as "the attentive nurse who made the strange discovery." The Horse Guards notified, and a Guards surgeon coming to view the body and to formally report that the late officer was a woman. Consternation at the Horse Guards and a hasty decision that, in Army parlance, "The matter was now closed, and no further correspondence on the subject would be opened."

If it was a fact that Barry had audaciously bluffed the Army and the world for the period of 1813 to 1865, the years of her service, masquerading as a man and deceiving all, the only thing was to close down this rather upsetting incident and just carry on as if it had not happened.

In the Headquarters Mess of the Royal Army Medical College at Millbank, there exists a miniature of James Barry, showing an odd-looking head appearing out of a very high-collared uniform. The hair is clustered over the forehead in curls and brushed back in a wavy fashion. Eyes large and dark. Long, thin nose. Small, pursed-up mouth, and small chin sunk into the folds of the collar. The torso shown is so slender and child-like as to hardly bear the weight of the head. There also exists a pen and ink sketch of Barry wearing a uniform such as I described in the inspecting visit to New Amsterdam, the immense cocked hat being prominent.

It is indeed strange that such an interesting personality should have left so little mark in history, and we are forced to imagine that some important reason did exist for the hushing up of the true facts of this surprising performance. Even to-day it would be a Press scoop to discover that a senior Army officer was found at death to have been a woman. How much more so in 1865, when such an exploit would have been almost beyond the possible.

Editorial.

We hope to continue publication of the Journal for the duration of the War. During the late war we managed to produce a monthly journal and after the first few weeks articles of great value were received from officers with the fighting forces, as well as from officers in India, the Dominions and Colonies. From time to time, following the stabilization of the forces in certain areas, officers had sufficient leisure, especially in the winter months, to write up their experiences. In the present war, officers may have fewer opportunities, but we hope they will endeavour to assist us in keeping the Journal in being.

YELLOW FEVER.

Up to the present time the only insect vectors of yellow fever which have been found naturally infected are *Aëdes ægypti* in Africa and South America and *Aëdes leucocelœnus* and *Hæmagogus capricorni* in South America.

The mosquito can only become infected by sucking blood from an infected man or monkey during the short time that the virus is circulating in the peripheral blood-stream. This fact, combined with the short life of the mosquito, makes it very difficult to account for the persistence of yellow fever in certain rural areas during dry seasons when mosquitoes are absent or present in only small numbers. It has been suggested that there may be other insect vectors of yellow fever which either live longer than mosquitoes or transmit the virus hereditarily.

Recently Findlay and MacCallum have shown that it is possible to infect both the Indian rhesus monkey (*Macacus mulatta*) and the African guenon (*Cercopithecus æthiops*) by putting yellow fever virus into the gastro-intestinal tract.

These observations are of great interest as feeding experiments with viruses have not as a rule been successful, probably because of the inhibitory action of the acid gastric juice.

As a result of the discovery of the poliomyelitis virus in the intestinal tract there seems little doubt that this virus may pass through the stomach and since it can be isolated from the mesenteric glands post mortem it probably passes through the intestinal mucosa.

Findlay and MacCallum's experiments have now shown definitely that the virus of yellow fever may produce infection in monkeys by penetrating the lining of the alimentary tract, as well as by passing through the skin, the olfactory mucosa and the conjunctival sac.

They employed five strains: highly virulent, pantropic, French, Asibi, and Gold Coast viruses ; the neurotropic mouse brain passage virus ; and the attenuated pantropic tissue culture virus 17D, which is now injected subcutaneously for human immunization.

The material to be administered was taken up in a one cubic centimetre syringe, which was connected to a fine flexible catheter about eight inches long. In the majority of monkeys the catheter was passed readily down the œsophagus without the use of force, and when it was felt that it would not move further the barrel of the syringe was pushed home. While contamination of the pharynx could not be absolutely excluded, the greater part of the inoculum was deposited in the stomach or lower part of the œsophagus. Twenty-seven rhesus monkeys were infected by the alimentary tract. Of eight monkeys which received the virulent pantropic virus, five succumbed in six to fourteen days. All these monkeys had macroscopic and microscopic lesions in the liver and stomach characteristic of yellow fever, and from the liver and blood viruses were obtained which, injected intracerebrally into mice, produced an encephalitis indistinguishable from that caused by the yellow fever virus. This virus in mice was neutralized by immune yellow fever serum.

Three monkeys which recovered after feeding with the virulent virus had a febrile attack during which virus was isolated from the blood ; they were found to be immune to yellow fever when subsequently tested by the mouse protection test.

In view of the results obtained with the virulent pantropic virus the effect of administering the neurotropic virus and the attenuated pantropic virus 17 D was tested on rhesus monkeys. When injected subcutaneously neurotropic virus generally produced a short febrile reaction. After administration of the virus by a catheter a short febrile reaction occurred in all the monkeys in four to six days and the virus was then present in the blood-stream. None of the monkeys died and all had immune bodies in the blood.

Rhesus monkeys fed on pantropic tissue culture 17 D by the mouth showed no definite clinical reaction ; virus was found to circulate in the blood, but the date of its appearance was irregular and in six animals could not be detected until the ninth or tenth day after breeding. All the animals had immune bodies in their serum three or four weeks after the administration of the virus. The virus could not be found in the urine or fæces of the monkeys fed on culture virus or in those fed with virulent pantropic strains.

Attempts were then made to see if monkeys other than the Indian rhesus could be infected by feeding with virus. *Cercopithecus æthiops*, one of the most common monkeys in yellow fever areas in Africa, shows no reaction when inoculated subcutaneously with virulent yellow fever virus.

although the virus is present in the blood for a limited period and immune bodies subsequently develop. Immune bodies have, however, been found in the blood of *Cercopithecus* monkeys from various regions in Africa where yellow fever is endemic.

The available monkeys were fed with Asibi pantropic and French pantropic strains of virus: none of them showed any reaction; the virus was present in the blood-stream in three to eight days after feeding and immune bodies subsequently developed.

In view of the results obtained in the immunization of Indian and African monkeys by the mouth, attempts were made to produce immunity by the same route in man and in certain other animals. The neurotropic and French pantropic strains of yellow fever virus failed to produce any signs of immunity in dogs, rabbits, guinea-pigs, rats, mice, hens, and pigeons. The virus could not be isolated from the blood and no immune bodies could be demonstrated in the blood three to four weeks later.

In the experiments on man attenuated tissue culture (17D) was alone given. Six volunteers were fed with dried virus, but none of them experienced any reaction and in no case was the virus detected in the blood. The serum tested after three to six weeks showed no immune bodies.

The failure to produce immunity in man would appear to be due to the rapid destruction of the yellow fever virus by the acid gastric juice. Dr. Martin has mixed culture virus with gastric juice and kept the mixture at 37° C. for fifteen to forty minutes. The mixture was then passed through Seitz E. K. filters, brought to neutrality and then inoculated intracerebrally into mice. No virus could be detected, although a control of virus and of phosphate buffer at pH 7·2 kept at 37° C. for forty minutes still showed the presence of virus.

Discussing their failure to infect man and certain animals Findlay and MacCallum state that the reasons for this failure are uncertain. In man gastric juice inhibits the virus in fifteen minutes. In rhesus monkeys material removed from the stomach at varying intervals after a meal up to three hours was found to have a pH of 4·0 to 4·5. At this pH the yellow fever virus is known to be rapidly inhibited. It was noticed that food removed from the monkey's stomach was not in a fluid condition but formed a firm pultaceous mass. Distilled water given to the monkeys six hours after food was found to have completely disappeared from the stomach twenty-five minutes later, either because the fluid had been absorbed through the gastric mucosa or had entered the duodenum. It therefore seems probable that either the yellow fever virus rapidly passes through the gastric mucosa or rapidly enters the duodenum, the reaction of which is alkaline.

Findlay and MacCallum think that if it were possible to overcome the acid gastric juice it might be feasible to employ the alimentary tract for immunization in man. They propose to describe efforts at elaborating such a method in a further communication.

The ease with which monkeys can be infected by the mouth, raises the question whether under natural conditions the alimentary tract may occasionally serve as a portal of entry for the yellow fever virus. As we have already stated the only insect vectors which have been found naturally infected are *A. ægypti*, *A. leucocelœnus* and *Hæmagogus capricorni.* When once these mosquitoes become infected, they remain infective for life although they show no pathological lesions as a result of the multiplication of the virus in their tissues. In *A. ægypti* there is no evidence that the virus can be transmitted hereditarily through the ovum or from one sex to the other. As the mosquito can only become infected during the short period that the virus is circulating in the blood of infected man or the monkey, Findlay and MacCallum consider that to explain the persistence of yellow fever in rural areas, there must be other insect vectors either longer lived than mosquitoes or capable of transmitting the virus hereditarily.

Up to the present no other biting arthropod has been found to be of importance in the epidemiology of yellow fever. Findlay and MacCullum considered that since many species of monkeys are known to eat grubs and insects in addition to their mainly vegetarian diet, a study of non-biting insects should be made. A study of the survival capacity of the virulent pantropic virus in non-biting insects has already shown that in the cockroach, *Blatella germanica*, the virus can survive for at least fifteen days.

After the isolation of yellow fever virus continually improved methods of immunizing human beings have been evolved. The inoculation of dead virus, even in large quantities, has been found to be quite ineffective. The aim has been to find a living strain that will produce satisfactory immunity without causing marked reactions. Such an attenuation has been found to occur after many passages through tissue culture with minced chicken embryo. At first it was thought to be necessary to give large amounts of serum at the same time as the virus. This was unsatisfactory on account of the discomfort to the patient and the difficulty of obtaining sufficient quantities of human immune serum. For over two years the attentuated virus has been given subcutaneously without immune serum both in London and America with good results and little after-effect.

If the method of oral administration of the vaccine virus on which Findlay and MacCallum are now working should eventually prove to be successful, it would greatly facilitate the administration of the vaccine especially under jungle conditions.

Clinical and other Notes.

TRANSPORT OF WOUNDED: THE STRETCHER USED AS A SPLINT.

By Captain D. G. DUFF, M.C., F.R.C S.Edin.,
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Following some experience in rock climbing accidents, a stretcher system was worked out which, I think, might possibly be of value in Service conditions on land, in the air, or at sea.

It seemed to me that the transverse bar ordinarily used for a Thomas'

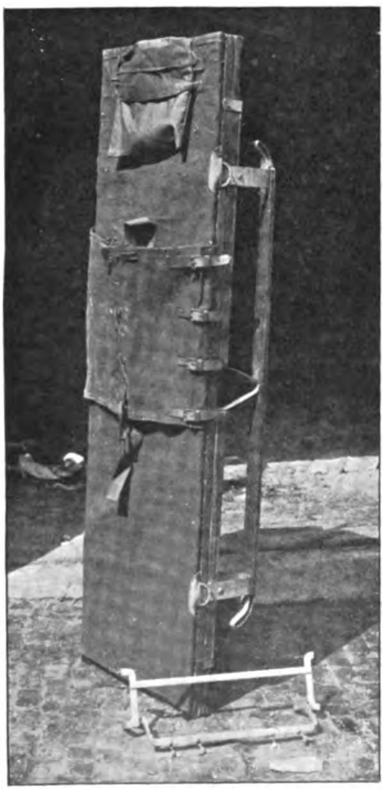


Fig. 1.

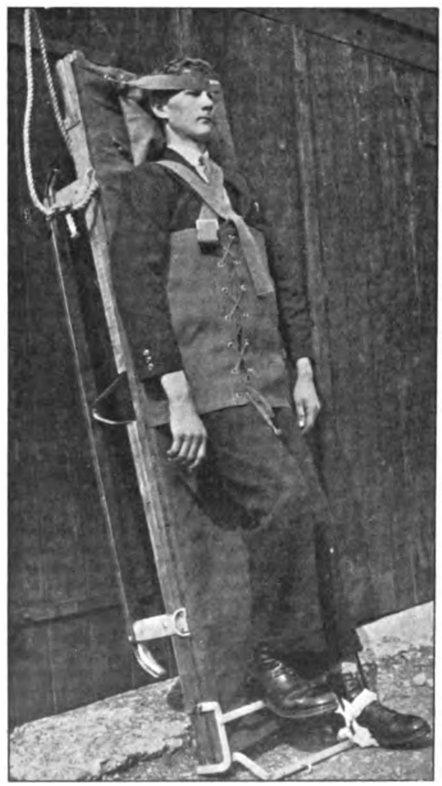


Fig. 2.

Fig. 1.—Telescopic handles on this climbing stretcher extend out 40 inches to allow good visibility to bearers. The stretcher folds in the ordinary way when the transverse bar is taken off.

Fig. 2.—Mountain stretcher. Note head band which secures the pillow, and also the head if fracture of the cervical spine is suspected. The stretcher is 6 feet 3 inches long.

splint might be developed to give security to patients in difficult situations. Clamping hooks to fix the lower end of a Thomas' splint were inserted in a transverse bar of adequate strength, and the bar itself fixed by screw

pins through the stretcher poles at the site of an existing metal fixture. If the patient and the upper end of the Thomas' splint are now bound to the stretcher by a broad canvas belt he is so securely splinted that he may be comfortably raised or lowered by ropes even in vertical positions. A standard stretcher was converted to embody these points, and it was approved after test by the First-Aid Committee of Mountaineering Clubs. It will be seen that tilting of the patient in any direction can be carried out without giving rise to undue apprehension. It may be noted, too.

FIG. 3.

FIG. 4.

FIG. 3.—All-metal stretcher. The foot end. Traverse is shown reversed for use as transverse bar.

FIG. 4.—Stretcher is shown collapsed.

that the central struts allow of the insertion of a pole, on which if the stretcher is pivoted rocking movements for artificial respiration may be carried out.

Modern warfare demands a metal stretcher, and an all-metal collapsible stretcher incorporating the above features has been made. It has only one detachable part, i.e. the traverse at the foot end, which when inserted on the top side becomes a transverse bar. It will collapse to a package

4 feet 2 inches by 8 inches. A sliding attachment with two clamps is used to fix the bottom end of a Thomas' splint. A " body belt " of chain link fencing, which adjusts for different girths, secures the patient to the stretcher. This firm splinting of the patient to the stretcher is, I am sure, a great factor in diminishing mental and physical shock, even in cases where there are no fractures of ribs, spine, or pelvis to be kept at rest by the body belt. This belt, by the way, can be easily detached and reattached at other levels if required.

The method may be used not only in getting patients from the upper stories of houses, from dug-outs, or from ship's holds, but also in aeroplane transport of wounded. Four spiral springs hooking between the stretcher bed and lower edge of the belt are provided for cases where the Thomas' splint is unnecessary. In these cases the patient is supported as in a breeches buoy and can stand on the transverse bar. It is hoped that the advantages of the Neil Robertson stretcher are gained to a great extent, without any need to disturb the patient's position between the scene of accident and the hospital bed.

A simpler stretcher, to fold once only in orthodox manner, can be very cheaply made, and also a double tongs collapsible metal trestle to fix below the traverses and thus convert the stretcher into an emergency bed. If a greater clearance were given in the centre of the head-end traverse it would be possible to fix skids (e.g. ski) and so ease work for the bearers in carrying on snow surfaces or down grass or scree slopes.

I should be glad to have a comment or criticism of the arrangement suggested above. It should be added that the Thomas' splint shown (made for me by Philip Harris, Birmingham) has a ring adjustable to all sizes between 15 and 26 inches, and is strong enough for use like a calliper.

I am indebted to the Chairman (Dr. Lapage) and his associates of the First-Aid Committee of Mountaineering Clubs, and to Lieutenant-Colonel Coates, M.C., i/c A.R.P. for Denbighshire, for their encouragement in the working out of these stretchers.

TREATMENT OF GONORRHŒA IN THE MALE WITH 2-SULPHANILYL-AMINOPYRIDINE (M & B 693: DAGENAN).

By Captain J. M. OFFICER,
Royal Army Medical Corps.

These notes are written with the object of bringing to notice a truly remarkable drug, which will revolutionize the treatment of gonorrhœa. Gonococci disappear from the urethral smear within two days and clinical cure is obtained within a week without irrigations.

Batchelor and his co-workers [1] have published a report on 102 cases and conclude that it is the most potent anti-gonococcal agent available at present.

Marinkovitch [2] has compared its effect with prontosil album and uleron. He obtained a permanent cure in 46·3 per cent with prontosil, in 56 per cent with uleron, and in 86 per cent with M & B 693.

The drug will be very useful in increasing the efficiency and maintaining the fighting strength of units, as return to duty can be obtained in just over a fortnight, and in certain cases in under a fortnight.

It is realized that the number of cases under review is small, but the results have been so striking that they are considered worthy of publication.

Forty cases were treated, of which 20 had received no previous treatment, and 20 were subacute or chronic cases which had failed to respond to sulphonamide and other treatment.

The results indicate a high proportion of apparent cure and no toxic effects were encountered.

GROUP "A."—CASES WHICH HAD RECEIVED NO PREVIOUS TREATMENT.

(*Acute Anterior and Posterior Gonococcal Urethritis.*)

This group consisted of 20 cases, of which 16 were anterior and 4 posterior infections.

Treatment with M & B 693 was commenced as soon as a diagnosis of gonorrhœa was made.

Treatment consisted of 6 tablets (3·0 grammes) of M & B 693 daily for five days and 3 tablets (1·5 grammes) for a further three to five days. No other treatment was given during the first five days and the patient was allowed up as soon as the urethral smear showed no gonococci—usually on the third day.

An alkaline diuretic was only given if the patient complained of pain on micturition. He was encouraged to drink as much barley water as possible, at least five pints per day. The diet was of course egg and onion free, and the bowels were kept open with cascara.

On the sixth day, if there were still threads in No. 1 glass, irrigations with 1:4,000 zinc sulphate were given once a day for three days. This was only required in a certain number of cases—notably those who gave a previous history of gonorrhœa

Treatment was stopped on the tenth day, and the patient was discharged hospital on the seventeenth day (average), after having had two negative P.M.s and no relapse on instrumentation with straight and curved sounds.

Of the 20 cases treated, 19 were discharged hospital to surveillance—apparently cured—after an average of 17·4 days in hospital. An apparent cure of 95 per cent

One case failed. This was still showing gonococci after five days treatment, and the drug, of which there was only a limited supply, was stopped on the sixth day. This case failed to respond to sulphonamide at a later date.

The following cases are typical examples of fresh infections treated with M & B 693 :—

Case 1.—Private C.

December 29, 1938: Admitted with profuse thin white urethral discharge. Gonococci present, urine (1) hazy, (2) clear. Placed under treatment with M & B 693 on the same date.

December 31 (2nd day): Gonococci absent. Both urines clear.

January 2, 1939 (4th day): No smear available.

January 6 (8th day): Treatment stopped.

January 8 (10th day): Sounds and P.M. Nothing abnormal found.

January 12 (15th day): *Discharged to surveillance.*

March 4: Urethroscopic examination—nothing abnormal found.

March 5: N.S.A. Both urines clear after a provocative of 400 mil. polyvalent vaccine.

March 6: Prostatic smear showed no pathological organisms or pus cells. *Clearance Certificate issued and struck off surveillance.*

Case 2.—Private D.

March 8, 1939: Admitted with a profuse thick yellow urethral discharge. Urines (1) hazy; (2) clear. Very many gonococci present. Placed under treatment with M & B 693 the same day.

March 9 (2nd day): Thin watery gleet, epithelium and debris. Gonococci absent. Urines clear.

March 13 (6th day): Sounds and P.M.—nothing abnormal.

March 16 (9th day): Treatment stopped.

March 19 (12th day): Prostatic smear—epithelium and debris only.

March 22 (15th day): *Discharged to surveillance.*

Group "B."—Subacute and Chronic Cases which had Failed to Respond to Sulphonamide.

These consisted of twenty cases which had been in hospital for an average of twenty-eight days before M & B 693 was commenced. All had gonococci in the urethral smears and four cases were complicated with epididymitis.

Treatment, as in the acute cases, consisted of 3 grammes of M & B 693 daily for five days and 1·5 grammes daily for a further five days, with no other adjuvant treatment.

Gonococci disappeared from the urethral smears in fifteen cases after two days treatment.

Six of these relapsed as soon as the drug was stopped. They might have been cured if the drug had been kept up for a longer period, as is recommended by Marinkovitch [2], who advises a 21-day course. This was impossible owing to the limited supply of the drug available.

The remaining nine cases were discharged hospital, clinically cured within an average of 19·5 days after commencing the drug.

Of these nine successful cases: Two had been in hospital for over six weeks and were still showing a profuse discharge when M & B 693 was commenced. They were both *dry* within four days. Two had been unable to

take sulphonamide owing to cyanosis and vomiting. These two cases had no toxic reaction with M & B 693. Two had developed epididymitis, while on sulphonamide, and this cleared up within five days of commencing M & B 693.

Thus of twenty cases, which had failed to react to sulphonamide, only five, i.e. 25 per cent, failed to respond to M & B 693.

The following three cases are typical examples of the cases treated with M & B 693.

Case 1.—Private M.

Patient had been in hospital eight weeks, during which period he had received a course of sulphonamide (84 grammes) for twenty-one days. Gonococci disappeared from the smear, but returned when sulphonamide was stopped.

January 24, 1939: Gonococci still present, M & B 693 commenced: two days later no urethral smear was available—both urines were clear—prostate was normal, and prostatic smear showed no pathological organisms or pus cells.

January 31: Treatment stopped after a course of 19·5 grammes of M & B 693.

February 8: *Patient discharged to surveillance apparently cured.*

April 4: Struck off surveillance after test of cure.

Case 2.—Private F.

Patient had been seven weeks in hospital as a gonorrhœa relapse. He developed epididymitis ten days after admission while still on sulphonamide. In spite of treatment with sulphonamide for twenty-one days—a course of 84 grammes—he persistently showed gonococci and there was no improvement in the epididymitis.

January 3, 1939: Sulphonamide stopped.

January 26: There were still many gonococci in the urethral smears. The right lobe of the prostate was enlarged and the right epididymis was swollen and tender.

January 28: M & B 693 therapy was commenced. After two days treatment epididymitis had almost subsided and no smear was available.

February 3: M & B 693 stopped. The patient had been "N.S.A." for seven days. Both urines were clear, epididymitis and prostatitis had completely subsided. Prostatic smear was negative to gonococci and only showed a few pus cells.

February 13: *Patient discharged to surveillance apparently cured.*

April 11: Struck off surveillance after test of cure.

Case 3.—Private R.

Had been in hospital for fourteen days, during which time he had received 70 grammes of sulphonamide.

January 28, 1939: Patient still had a profuse urethral discharge, showing many gonococci. M & B 693 commenced.

January 30: After two days treatment no smear was available and both urines were clear.

February 4: Treatment stopped.

February 13: *Patient discharged to surveillance.*

April 11: Struck off surveillance after test of cure.

Standard of Cure.

Patients were kept in hospital for a week after all treatment had ceased. During this time, in addition to the absence of urethral discharge and clear urines, prostatic smears had to be free from pathogenic organisms and relatively free from pus cells on two occasions. Instrumental investigation with straight and curved sounds had to show no abnormality. Patients were kept under observation for a further period of two months after discharge from hospital. During this period they were examined once a week during the first month and fortnightly during the second month. During the second month they were detained for forty-eight hours for thorough investigation—when they were given a provocative dose of 400 million of polyvalent gonococcal vaccine: urethral and prostatic smears were examined twenty-four and forty-eight hours later. Urethroscopy was also performed at this time. This has not yet been done in all cases.

The gonococcal complement-fixation test was not performed, as this test could not be carried out in the Military Laboratory.

Conclusions.

(1) M & B 693 treatment resulted in clinical cure within a week in 95 per cent cases of fresh infections.

(2) There is no necessity to wait for immunity to develop.

(3) No irrigations are necessary. A certain number of cases were given irrigations with 1:4,000 zinc sulphate between the fifth and eighth days for its stimulating and healing effect.

(4) Complications do not have time to develop.

(5) Only 45 tablets (22·5 grammes) of M & B 693 were required—an actual cost of about 12s.

(6) 75 per cent of chronic cases which failed to respond to sulphonamide reacted to M & B 693.

(7) There were no toxic symptoms.

(8) Complications originally present, such as epididymitis, improved rapidly.

Acknowledgments.

In conclusion the writer would like to thank Lieutenant-Colonel C. F. Burton, M.C., Senior Medical Officer, Shanghai Area, and Major J. M. Mackenzie, O.B.E., M.C., Officer Commanding, British Military Hospital, Shanghai, for their helpful criticism and permission to forward these notes for publication; Dr. Robert Lees, Edinburgh Royal Infirmary, for much

useful information; Serjeant R. Ancell and Private F. Boustead of the Royal Army Medical Corps, for their assistance; and Messrs. May and Baker and Messrs. Olivier-Chine for a supply of the drug.

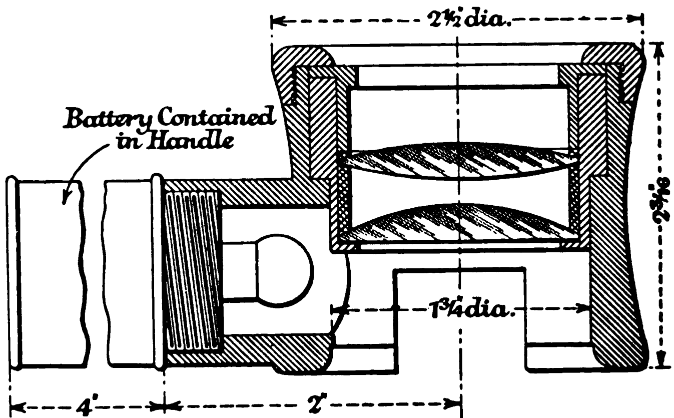
REFERENCES.

[1] Batchelor, Lees, Murrell, and Braine. *Brit. Med. Journ.*, December 3, 1938.
[2] Marinkovitch. *Ibid.*, February 18, 1939.

THE "PARTINGTON" ILLUMINATED MAGNIFIER.

This apparatus gives a magnification of 30 diopters and consists of a bakelite cylinder with a lens fitted at the top. Illumination is intense and is obtained from an electric bulb connected with a small dry battery. The area covered by the lens and illuminated is circular and some 2 inches in diameter. An opening at the side of the cylinder allows the use of a scalpel or forceps in connexion with the object under examination. The apparatus is strongly made and compact and is only some 7 inches long.

It is likely to prove of particular value to officers of the Naval, Military and Air Force Medical Services, as it facilitates very materially



the early detection of such conditions as infestation with lice and scabies, and the diagnosis of various skin conditions. It is likely to prove of value also to the ophthalmologist and entomologist.

The apparatus, price 27s. 6d., can be obtained from S. W. Partington, 68, Gloucester Road, S.W.7.

Travel.

SOME BRIEF DETAILS OF A TRIP DOWN THE IRRAWADDY AND A TRIP UP THE GANGES-BRAHMAPUTRA.

By Major R. A. ANDERSON,
Royal Army Medical Corps.

At the request of some officers of the Corps, the following few notes are given which may be of use to others by suggesting a way of utilizing leave in India when it is short, and particularly when it is only available in the winter.

Owing to the exigencies of the Service the usual privilege leave was not available in 1938 (as far as we were concerned), consequently one month's leave was obtained from December 29, which was allowed to count in 1938 without prejudice to leave of 1939. We have always had a desire to see something of Burma, and also to explore the region of the outlet of India's largest rivers (Ganges and Brahmaputra). Although the time for the above somewhat ambitious project was short, nevertheless we enjoyed every minute of it.

To begin with, it was found to be extraordinarily difficult to obtain information with regard to the river trips on the Irrawaddy and the Ganges-Brahmaputra. Few people seem to know about them. It was surprising, with regard to Burma, how little information could be obtained from those stationed in Burma about the Irrawaddy trip. The impression was that the trip was seldom made. We felt that had we been stationed in Burma, it would have been one of the first ways of spending our leave. Lest this impression should be a mistaken one, apologies are offered in advance.

The leave commenced from Naini Tal, where one had been officiating in an appointment at Headquarters, Eastern Command. It is not proposed to burden this narrative with a description of the journey to Calcutta. The journey can be performed very comfortably either by train or by car.

As the leave dates had of necessity to be fixed ones, the itinerary had to conform with these dates. Arrival in Calcutta was on December 31, in time for the New Year festivities. Calcutta apparently being inhabited mostly by those of Scotch extraction meant that the New Year festivities were all the more hilarious. After the quietness of Naini Tal in the winter, Calcutta was certainly a very welcome diversion. The cabarets were excellent, music grand, and in every way it was a magnificent method of "seeing in the New Year. . . ." Though towards the end of a third tour in India we had not had the luck of seeing Calcutta before, consequently the hustle, bustle and excitement were appreciated. The only unfortunate circumstance was the fact that we had to be on board the boat for Burma next day before 7 a.m.—perhaps a hazy embarkation.

It should be noted here that this time of the year (December and January) are the most ideal, as regards climate, for both Calcutta and Burma. English clothes can be worn practically all the time and are in fact essential in the evenings. The boats which run from Calcutta to Rangoon are of the B.I.S.N. Co., and are very comfortable. The boat which sailed on the morning of January 1 was the S.S. "Ekma." *Passports are necessary, also vaccination certificates.*

The journey down the Hoogly to the open sea is very interesting. Calcutta was much more inland than we had realized—presumably something between 60 and 80 miles down to the Bay of Bengal. Crossing the Bay of Bengal at this time of the year is very pleasant, occupying two and a half days and two nights. We arrived at Rangoon after lunch on January 3.

Arrangements had been made to proceed up country on arrival and to stay in Rangoon on the return journey. Baggage was sent direct to the railway station in Rangoon, while we drove round in a taxi seeing the Royal Lakes and the famous Schwe Dagon Pagoda, arriving back at the station to catch the 4.10 p.m. train for the North. The railways in Burma are narrow gauge, spotlessly clean and quite comfortable. The absence of dust was particularly noticeable when compared to travelling in India. There was no restaurant car on this train, but a stop was made at a station (Pymentazu) for dinner in the refreshment room there. The food provided was excellent and the service good. We considered arrangments better than in India. In all narrow-gauge railways vibration and rocking are more than on broad gauge. For comfort on rail travel nothing can beat Li-Lo beds, which are easy to carry about, and occupy little space in valises.

We arrived in Mandalay at 5.45 a.m. on January 4, while it was still dark. It should here be noted that there are no hotels in Mandalay. There is a Rest House belonging to the Railway Company, where one can stay. It is near the station. Booking of accommodation beforehand is required. Meals are supplied in the refreshment room of the station and are very good. The Fort at Mandalay (Dufferin Fort) is undoubtedly picturesque, with its magnificent moat and bridges across. Now-a-days in India one does not often find the moats round forts with water left in them. Inside the fort walls is a large cantonment, resembling Richmond Park: the Queen's Palace is in lacquered wood of gold, red and black, with its high pagoda pinnacle. The walls of the Fort are surmounted at intervals with pretty minarets and pagodas, which in the evening light are beautifully reflected in the water of the moat.

The usual methods of transport are available in Mandalay, trams, taxis and buses, but the most surprising affair is the bicycle sidecar taxi, just like an ordinary motor bicycle and open side car, except that it is attached to an ordinary push bike. There were thousands of these quaint contraptions which we had never seen before. There were no rickshaws. Practically all the houses are of wood, even double-storey ones. These wooden houses of Burma are quaint, being built as it were on stilts—cattle, etc., are kept under the

house. Many of the streets in Mandalay are numbered as in America, such as 42nd Street, 68th Street, etc. Having done a tour in China and visited Japan we found many things in Burma similar. The Burmese are attractive. happy and smiling; their gaily coloured clothes are fascinating. Undoubtedly Mandalay remains the city of romantic fame one reads about. It is unspoilt by the craze of the present mechanical age and over-commercialization. It leaves an impression in the mind of a "Toy City."

While in Mandalay a visit was made to Amarapara, the old capital, which was interesting as regards its innumerable pagodas and silkweaving industry by handlooms. Amarapara is about 8 miles out of Mandalay and is reached by hired taxi. A visit was also made to Maymyo (Burma's hill station). The journey was made in a hired car leaving early in the morning. The distance from Mandalay was only 42 miles and it was a delightful car run through interesting wooded country. [A cheaper way to go, when time is no object, is by rail.] The road through the forest at this time of the year when the trees are bedecked with autumn tints is hard to surpass. The road is good—tar macadamed—and there was a welcome scarcity of the bullock-cart seen so much in India. Peculiar to relate those seen had road sense and kept on their own side of the road. The Burman apparently is gifted with an intelligence far ahead of that of the Indian. Parts of the route reminded one of the area around Brockenhurst and Beaulieu. . . There is a good cafe in Maymyo called "The Unica" where excellent meals can be obtained, including at this time of the year magnificent strawberries and cream. The visit to Maymyo can be done comfortably by car, starting early in the morning and getting back in time for lunch.

The Bazaar in Mandalay is well worth a visit. It is not like the usual bazaars in India. It is enclosed and consists of a huge series of blocks, each resembling a market place. It is said that it is the largest roofed bazaar in the world with every kind of shop in it. This bazaar alone would take days to explore. Some of the industries we were interested in seeing were jade carving, ivory carving, jade polishing and the cutting and polishing of rubies. Our itinerary only gave us two complete days and nights in Mandalay and they were busy ones. For the use of others a brief itinerary will be given at the end with some idea of costs.

The return from Mandalay was by river steamer down the Irrawaddy. The Irrawaddy Flotilla Company own a large fleet of very fine river steamers, which are very comfortable, and the messing on board is excellent. We were due to sail at 7 a.m., so we arranged with the Company to be allowed to go on board about 11 o'clock the night before, as the river is about 4 miles away from Mandalay. The name of our steamer was the P.S. "Kawal." Practically all of the river steamers are side paddle boats with about 8 two-berth first-class cabins. These have proper beds—not bunks. On the wide and spacious top deck there are many shops for the deck passengers, where all their requirements can be obtained. These are of great interest and we understand are more so on the bazaar boats which go up into Upper Burma.

We sailed at 7 a.m. and the river looked fine with all the pagodas silhouetted against the skyline in the early morning sunlight. We soon passed under the very large railway bridge over the Irrawaddy, the spans of which are forty feet high on account of floods. The journey down the Irrawaddy constantly presents an interesting panorama. Stops are made frequently at pontoon landing stages. Navigation has been brought to a fine art; the steamer is very quickly tied up and off again before you realize you are stationary. The handling of these steamers reminds one of the Mersey ferries at Liverpool, efficient to the last degree. Very often halts were made about every ten minutes where there was no landing pontoon at all—merely the sandy bank. This operation was worth watching. The steamer would nose up to the bank, swinging round upstream, while some of the crew jumped overboard with the ropes to make fast. Everything was done very quickly and cleverly. The names of some of the regular places called at are amusing. Here are a few: Sagaing—Mayogan—Nagebouk—Myedaw—Ava—Kyauktalon—Ngazun—Myinmu, etc.

We tied up for the night at Myingyan about 6 p.m. Certain parts of the river being very shallow, navigation at night is difficult, even with the searchlight which all the steamers carry. There was a very fine sunset—pale shades of violet and mauve. There were only two other first-class passengers on board in addition to ourselves. Mosquito nets are supplied both in the Railway Rest House in Mandalay and on these steamers of the Irrawaddy Flotilla Company. When tied up at night one can always go for a walk on shore and visit the local villages. The river is very wide in places and narrow at others, and is always a source of interest. The channel is marked out by bobbing poles. Those on one side are painted red at the top, those on the other side have the tops painted white. These poles are anchored. It was noticed that each pole had something hanging from the top, which appeared to glint every now and then. We later discovered their purpose, when travelling with the searchlight on. These are discs of brightly polished tin which catch the light of the searchlight, making the course more easily picked up. A novel invention and very different from the coloured lights seen in the Suez Canal. Another river steamer, on its way up river, was also tied up at the same place as our boat. This was one of the new boats, so we went over it.

We were fortunate in our trip coinciding with the period when the moonlight on the river was at its best. Next day the steamer left at 5 a.m. with the searchlight full on. Watching the dawn and the sunrise was worth the early awakening in the cold. Tea and fruit were produced even at that early hour. There was no question of toddling out in a dressing gown—an overcoat was required. One item here is of use, viz. the old Indian custom of "Brunch" still exists in parts of Burma. That is very late breakfast about 11 a.m. including meats, etc.—no lunch—and early high tea. This should be remembered because if lunch is ordered, it is supplied as an extra with payment, and is not really necessary.

The course of the river during the second day was through country which is very fertile, well cultivated and with little hills on both sides. Speaking generally it was noticed that Burma is much more cultivated than many parts of India. None of those large tracts of barren, brown and baked land is seen as in India. Many towns were called at during the day: Yebai, Pakokhu, Letpenchibaw, Myitchu, Pagan, Yenangyat, Lanywa, Singhu, Chouk, Sale, Sinbuygyan, Kyaukye, Thangyne, Nyounghla. One place, Nyaungoo, produced a great deal of the Burmese lacquer. Merchants visited the steamer with their wares which were very cheap, and various specimens were purchased.

During the trip many rafts of teak are seen proceeding down the river to the coast. These consist of hundreds of teak logs tied together. Each raft has one or two chittai huts on them and a staff or family of twelve to fourteen persons. The teak comes from the teak forests in Upper Burma. The rafters are born in the job and do nothing else. Apparently they have been doing this work for generations. They can only do two trips per year, because it takes five months to do one trip down to the coast from the teak forests in Upper Burma. There is a great deal of freemasonry among these people. In many places where a raft had drifted on to the shoals, other rafts had stopped and all helped to get it off—no light undertaking. At one place along the bank there was a collection of these rafts about a mile long. It is said there was one million pounds worth of teakwood in this spot alone. Each raft carries one or two flags. Should we ever have an opportunity of visiting Burma again, we shall certainly go up river into Upper Burma to see the elephants hauling these teak logs down to the river.

The river steamers burn mostly wood logs in their engines and this produces a very nice aroma. Towards the evening of the second day we passed through some oil fields with masses of oil derricks. Of course the chief industries of Burma are oil and teakwood, then comes lacquer and precious stones, rubies, jade, etc. There were a good many mountains on each side now, one of which was called Mount Poppa. Another very fine sunset was seen with the reflections of every colour of the rainbow on the ripples of the water following us. The second day had been a busy one, because a large amount of cargo had been taken on at the various calling places, with the result that instead of reaching Myounghla at 6 p.m. to tie up, we reached there at 9 p.m. This place is one of the big headquarters of the Burma Oil Company, and we had arranged to go to the pictures there had we arrived in time. However, instead we had the fascination of travelling by searchlight.

The third day down the Irrawaddy was through country with well wooded cliffs and brightly coloured trees, until we reached Prome in the evening. During the trip down the Irrawaddy we saw enormous flights of wild duck on the river.

All our arrangements had been made through Thos. Cook & Son, Ltd. We had been given to understand that the river below Prome round to Rangoon

was not so interesting as the part we had seen, but the local people (European staff of the Burma Oil Company who came on board on the evening of the second day and who ought to know) say that it is just as good. The railway station at Prome was not far from the landing stage on the river. Coolies carried the luggage to the station and we took rickshaws. The train from Prome to Rangoon left about 9 p.m., arriving at Rangoon at 5.45 a.m. on January 9.

Our itinerary gave three days in Rangoon. We stayed at the Strand Hotel, which is an excellent one. Silk suits during the day add to comfort. Rangoon is quite a fine city and there is a good deal to see. Our visit coincided with the riots there, particularly at the Schwe Dagon Pagoda: however, we were not molested, and they did not interfere with sightseeing. The city appeared to us to resemble very much those of the Far East; fine buildings and shops. While in Rangoon, visits were paid to places where Burmese silver was turned out, the famous Scott Market, the Schwe Dagon Pagoda, The Royal Lakes with their very fine boathouse, etc. One might truly say that Burma is a land of pagodas. The religion of course is Buddhism, and it looked as if religion is of a very high order judging by the number of pagodas. At Pagan alone (on the Irrawaddy) there are 5,000 pagodas. At night many of them are flood-lit or the pinnacles are lighted with myriads of small lights, resembling an illuminated cone.

We considered flying back to India, but found we had far too much baggage, which would have been a bother. Another time we should fly, if on a short leave, because the time taken from Calcutta to Rangoon or vice versa is less than a day.

While in Burma opportunity was taken of making coloured cine films which included various parts of Rangoon, sunset on Rangoon harbour, sunset on the way up to Mandalay, Mandalay Fort, Maymyo and the river Irrawaddy. A fairly representative series of shots was obtained showing places, types of people, etc. These have since been received from London, processed, and are quite good.

We left Rangoon on January 12, after lunch. As the tide did not suit the time of sailing, we were taken out by tender to the ship in the stream—the B.I.S.N. Company's S.S. "Egra." The journey down from Rangoon to the Bay of Bengal appeared to be about 40 to 60 miles. There is ample room on these B.I. boats. We were given two 2-berthed cabins opposite each other which was very convenient for luggage. We were sorry our ten days in Burma were over.

We arrived back in Calcutta about 11 a.m. on January 15 and proceeded into the docks to tie up. We had disembarked by lunch time. On the way to Burma we had stayed in the Great Eastern Hotel, Calcutta, which is still shown in all the guide books as the premier hotel of Calcutta. On return we stayed in the Grand Hotel, which has been completely reorganized now under European management. We infinitely preferred it. This hotel has two magnificent orchestras—a Viennese one and also a Ladies Orchestra. The famous Casanova Restaurant is part of the hotel.

Our itinerary allowed us three days for Calcutta. While there, visits were paid to the Victoria Memorial, Khalifat Temple, Fort William, The Jain Temples in the city, Newmarket and the various shopping centres, and Belvedere (the residence of the Governor-General when in Calcutta). We also saw the Marcus Company in "1939 Follies" at the Empire Theatre. It was first-class show and is said to be the best that had ever visited Calcutta. The company of about 100 were living in the Grand Hotel.

On the night of January 17 we embarked at Juggernath Ghat on the River Steamers Navigation Company's paddle steamer "Kharoti," as it was due to sail some time during the night when the Howrah Bridge opened. The bridge opened at 2 a.m. and we proceeded down the Hoogly by searchlight. The steamer was quite large and comfortable. There was only one other first-class passenger in addition to ourselves, to occupy the ten two-berth cabins. The morning of the 18th was spent going down the Hoogly, then in the afternoon the steamer threaded its course through a maze of waterways in and out of the numerous mouths of the combined Ganges-Brahmaputra. Some parts were narrow, other places were very wide, and always twisting and turning like a jig-saw puzzle. We travelled at night with the searchlight on, and following the twists of the rivers and the traffic, it was weird to see the beams of the searchlights in all directions, rather like the Fleet at home at one of the seaside resorts. We did not stop anywhere, in fact there had not not been a village to be seen after we left the Hoogly. During the next day we passed through the Sunderbuns, through thick jungle and forest, with hardly a living thing to be seen. We were told that the only things to be seen were tiger, deer and crocodiles, but we did not see any except deer. We saw many flights of duck and could hear many different kinds of birds. The country is flat and entirely different to the Irrawaddy environment. The third day we traversed wider rivers with more villages and cultivated fields. No stop was made except for dense white fog in the early hours of the morning at 4 o'clock. In the evening we passed a big village called Barsal, where there must have been between 30 and 40 of these river boats. On the fourth day the route lay through a very wide river 4 to 5 miles wide—the junction of the Ganges-Brahmaputra. During the previous night we had to anchor again on account of dense fog. Each day there was brilliant sunshine and the wide rivers looked like smooth glassy calm seas, sparkling in the sunlight. This part of the river was more interesting on account of the amount of small craft with quaint sails, some red, some blue, and of various shapes. Some interesting shots of sunsets, with junks crossing the sunrays on the water, were obtained. On the fifth morning we arrived at Goalundo. We had originally intended going on to Gauhati—another four days' journey—but it must be admitted at once that the Irrawaddy trip had spoilt this for us. Had we made the trips in the reverse order it would have been better. Goalundo is where the railway meets the river traffic. It is not a fixed centre, being moved frequently up or down stream on account of floods, etc. The train for Calcutta was due to leave at 2.10 p.m. After lunch on board

we transferred to the train, and then had an annoying delay. The train has to wait for the mailboat from Chittagong. The boat was delayed for four hours by fog, with the result that we did not get away until 6 p.m. It was a slow train, we managed to get dinner down the line, and eventually arrived in Sealdah station, Calcutta, after midnight (12.30 a.m.) instead of at 8 p.m. The delay upset our arrangement of going to the pictures in Calcutta. A reference to the map is here necessary to understand why the return journey took such a short time by rail as compared to the five days by steamer. The following morning was a busy one in Calcutta—the usual last minute shopping and collection of mails and the world's news.

One or two explanatory remarks here would not be amiss. Perhaps it is unfair to compare the Irrawaddy river trip to that of the Ganges-Brahmaputra. They are entirely different in every way. Had one been convalescing after an illness, or required a complete rest, then nothing could be more effective than the latter trip. It certainly is the ideal of perfect peace and quietness. But to be perfectly honest, had we to do the tour again, without any hesitation we would have preferred to cut out the Ganges-Brahmaputra and given the time to going up the Irrawaddy beyond Mandalay. We have, on the other hand, the satisfaction of having done it, and had this not been so, there would have remained a hankering that we might have missed something. We still have the greatest regret that while stationed in China we were unable to do the trip up the Yangtze River.

The remainder of our tour is not perhaps of much interest. We had to get back to our permanent station (Dehra Dun) quite leisurely within the month. We had previously toured by car Cawnpore, Benares, Allahabad and Lucknow, for the purpose of getting coloured cine pictures of these places. Unfortunately at Lucknow the stock of Kodachrome films in India ran out and we did not finish Lucknow. Consequently on the way back from Calcutta we stayed a day and a night at Lucknow for that purpose. While on the tour we finished off eleven rolls of Kodachrome 1,100 feet. At the time of writing all have been received back from London and afford a very fine record of our tour.

To wind up this article an itinerary is appended and also some rough idea of costs.

Itinerary.

29.12.38 Departure at 4 a.m. from Naini Tal by car.

29th, 30th. *En route* to Calcutta.

31.12.38 Arrived in Calcutta.

31.12.38 Halt one day and night in Calcutta.

1.1.39 Departure from Calcutta at 7 a.m. by B.I.S.N. Company's " Ekma."

1st, 2nd, 3rd. Crossing Bay of Bengal.

3.1.39 Arrived Rangoon at 12.30 p.m.

3.1.39 Taxi drive round Rangoon on way to station.

3.1.39 Departed by 4.10 p.m. train from Rangoon to Mandalay.

4.1.39 Arrived Mandalay 5 a.m.—visited Dufferin Fort, market, etc.
4.1.39 Proceeded by hired car to Amarapara in afternoon.
5.1.39 Visited Maymyo by hired car, and returned for lunch.
5.1.39 Afternoon visit to Fort, market, jade carving, etc.
5.1.39 Embarked 11 p.m. on Irrawaddy Flotilla Company's P.S. "Kawal."
6.1.39 Departed 7 a.m. down Irrawaddy river.
6th, 7th, 8th. On the Irrawaddy river.
8.1.39 Arrived Prome in the evening—transferred to train which left at 9 p.m.
9.1.39 Arrived Rangoon at 5.45 a.m.
9th, 10th, 11th, 12th. Rangoon—Strand Hotel.
12.1.39 Departed from Rangoon at 5 p.m. by B.I.S.N. Company's "Egra."
12th, 13th, 14th. Crossing Bay of Bengal.
15.1.39 Arrived Calcutta at 11 a.m., proceeded into dock.
15th, 16th, 17th. In Calcutta—Grand Hotel.
17.1.39 Embarked on River Steamers' Paddle Steamer "Kharoti."
17.1.39 Departed down Hoogly at 2 a.m.
18.1.39 Going down the Hoogly during the morning—in the afternoon turned out of the Hoogly into the Sunderbuns.
19.1.39 Traversing the Sunderbuns.
20th, 21st. Going up the Ganges-Brahmaputra.
22.1.39 Arrived at Goalundo about noon. Departed from Goalundo at 6 p.m. by train for Calcutta.
22.1.39 Arrived Calcutta at midnight.
23.1.39 Departed from Calcutta.
24th to 27th. *En route* to Dehra Dun, halting at Lucknow one day and one night.
27.1.39 Tour ends at Dehra Dun.

COSTS (APPROXIMATE).

Only Calcutta back to Calcutta given, as the journey to Calcutta will depend on station in India.

Great Eastern Hotel, about Rs. 14 per day each.

First-class return fare, Calcutta to Rangoon	Rs. 212.0.0	each
Tax	2.0.0	,,
Rangoon Strand Hotel per day	14.0.0	,,
Rangoon to Mandalay rail fare, 1st class	45.0.0	,,
Railway Rest House, Mandalay, accommodation, food	12.8.0	,,
Car hire for Amarapara	10.0.0	
Car hire for Maymyo	12.0.0	
Irrawaddy Flotilla Company trip by boat, 1st class, without messing	50.0.0	each
Messing on board, per day	4.8.0	,,
Rail fare, Prome to Rangoon, 1st class	21.0.0	,,
Grand Hotel, Calcutta, per day	14.0.0	,,
1st class fare steamer trip Calcutta to Goalundo inclusive of messing	50.0.0	,,
Rail fare Goalundo to Calcutta, 1st class	19.6.0	,,

N.B.—We made our own arrangements for moving of baggage, cars for sightseeing, car visit to Maymyo, etc.

For example, sightseeing by car five hours in Rangoon quoted at Rs. 40 each, with guide Rs. 6. Cost us about Rs. 15.

Visit to Maymyo by car quoted Rs. 50, cost us Rs. 12, etc., etc.

Current Literature.

L. OTTEN AND I. PH. HENNEMANN. **Combined (Simultaneous) Immunization against Tetanus.** *Journal of Pathology and Bacteriology*, v. 49, No. 1, p. 213.

The authors state that active immunization against tetanus has become an established procedure, but active immunization combined with the prophylactic injection of serum has not been fully investigated. They have, therefore, tried to obtain experimentally more definite information on this problem by titrating the antitoxin during the first six weeks of the process of immunization, using toxoid and antitoxin as separate reagents and varying the doses and the sequence and intervals of the injections.

The inhibiting action of passive immunity on the development of active immunity is a well-known phenomenon which has been investigated mainly in relation to diphtheria by several workers. From their own experiments in relation to tetanus, Otten and Hennemann consider that the antitoxin itself whether heterologous or homologous must be held mainly responsible for the impediment to the development of active immunity. They doubt whether the combined method of immunization which gives the best results in guinea-pigs will be satisfactory for man. The immunological response of the guinea-pig is much stronger than that of man. Experimental research in guinea-pigs proves that the third to the sixth week constitutes the critical period, the passive immunity becoming exhausted while active immunity has still not reached the required level.

With three injections of formol-toxoid at ten-day intervals, the first two followed by injections of serum after twenty-four hours, this gap may be bridged (with dosage as applied in these experiments), the passive immunity passing into the active without any interruption.

The authors consider that the smallest dose of serum (given in one dose or in two doses with an interval of not more than ten days) should be found which will provide a titre of at least $\frac{1}{100}$ unit of antitoxin per cubic centimetre after four weeks. Similarly, a dose of toxoid is required which will produce active immunity to the same level in four weeks. These may then be combined, giving the toxoid first, and tested in a number of persons in whom the antitoxin level is carefully followed.

Owing to the interference of active and passive immunity, the doses which appear to be satisfactory when the reagents are given separately may not be suitable when they are given in combination. Only when there is certainty that a level of $\frac{1}{100}$ unit of antitoxin per cubic centimetre is maintained without interruption—the heterologous antitoxin being replaced gradually by the homologous autogenous antitoxin—and that this occurs regularly, should the universal application of the combined method be adopted. The authors emphasize this point, as most who have discussed combined immunization recommend it as a method which

is fully approved and from which success should be absolutely assured. They are doubtful whether a combined method for man can be found which will protect against the heavy and frequent infections of trench warfare, taking into consideration the fact that most of the persons at risk who are wounded have lost blood and are weakened and exhausted.

They consider that a certain guarantee against tetanus in time of war can be ensured only by active immunization of a whole army as is carried out in France and as has been applied in the army of the Dutch East Indies for the past four years.

KOENIG, R. Praktische Erfahrungen als Ueberwachungsarzt für Druckluftarbeiten. **[Experiences as Medical Officer to Workers in Compressed Air.]** *Zent. f. Gewerbehyg. u. Unfallverhütung.* 1939, v. 26., 1–6, 3 figs.

The author joins issue with those who, in recent publications, state that work in a caisson is no more dangerous than any other constructional work. In support he describes his observations during the construction of the piles for the 700-metre long bridge over the River Havel. During the work on the two middle piles there were in a relatively short time frequent and severe cases of caisson disease. The bed of the stream at this point presented a 20-metre deep bed of thick slime before a solid sand layer could be reached at a depth of over 28 metres below water level. The caisson's dimensions were 27·5 by 12·5 to 13·5 metres and 2·2 metres high. Before men could descend it was necessary to pump the slime from the sunken chamber as much as possible ; the edges of the chamber having reached as deeply as possible into the slime layer, compressed air was pumped in and the men descended. The problem was now to get rid of the residual slime and thus allow the caisson to get down to the firm sandy layers below. The slime was mobilized by means of hoses with a water pressure of eight atmospheres and driven into special depressions from which it could be aspirated to the surface. The men worked in groups of two, one having the nozzle of the hose and the other the length of tubing. This was extremely trying on the men ; they were frequently forced to adopt and maintain a stooping position for various unavoidable reasons, in addition they often sank over their knees in the sticky slime as well as frequently slipping on the moist slimy surface, and thus releasing the high-pressure hose, which could only be recovered with great difficulty. These circumstances made it essential for the men to wear waterproof clothing with all the consequent effects such clothing produces, especially when working hard in a restricted and already uncomfortable atmosphere.

Ventilation difficulties arose from the start as a result of the nature of the slimy layers which rendered the working chamber practically air-tight and thus the pressure rose to dangerous heights. Utilization of the existing ventilation plant raised a thick mist, particularly feared by the workers, and had to be abandoned. Automatic throttling of the compressor had

to be resorted to ; the compressor resuming when the pressure in the chamber had fallen to certain levels, the air in the meantime escaping through the slimy floor and under the cutting edge of the caisson. The consequence was that insufficient fresh air was sent down to the men ; in certain instances only two-thirds of the minimum requirements laid down in the German regulation of June 29, 1935. The author points out that these unfavourable conditions were entirely due to the unusual character of the river bed.

The figures for caisson sickness were diminished almost to one-seventh if the compressor was worked so as to yield two and a half times as much fresh air and was not throttled.

Examples are given to show the importance of the period spent in the chamber in the incidence of caisson disease. This is particularly seen in men unaccustomed to the work but may occur even in men who have had many years of service. Much of the work was carried out in the hottest summer months which, in conjunction with the saturated atmosphere and the impossibility of working with clothes off, led to symptoms in spite of many efforts at cooling ; it became necessary to diminish the working time.

All told, 145 cases of caisson disease were observed, and the majority showed muscle and joint symptoms. Paræsthesias and regional anæsthesias were observed. The pains sometimes shot from place to place and frequently there was loss of muscle power. Sometimes powerful young workers rolled helplessly on the ground in agonizing pain. At the higher working pressures severe circulatory disturbances were frequently observed after decompression. Most of these patients were deathly pale and collapsed ; they were confused, complained of headache, dizziness and flashes before their eyes ; on occasion there was lateral nystagmus ; some had frequent watery stools with abdominal pain, others vomited bile-stained fluid. Other symptoms were the occasional rupture of the drum, complaints of sleeplessness and loss of appetite, toothache, epistaxis, and loss of weight.

Very interesting is the author's admission that at first he was dubious about the advisability of recompression since it looked like putting an additional burden upon an already collapsed person, but after trying the usual methods for treating collapse, etc., he has been left with no doubt that the only effective treatment is recompression. The recompression need not necessarily proceed till the working pressure is attained, but of vast importance is the subsequent decompression, which must be slow. In a series of thirteen cases the author recompressed until symptoms disappeared and then decompressed at the rate of 1 metre water pressure per ten minutes ; the results were uniformly good. M. W. GOLDBLATT.

Reprinted from " Bulletin of Hygiene," Vol. 14, *No.* 7.

Reviews.

RHEUMATISM. By H. Warren Crowe, D.M.Oxon., B.Ch., M.R.C.S., L.R.C.P. Pp. xiv + 280. London: John Bale Medical Publications Ltd. Price 12s. 6d. net.

Chronic rheumatism, as opposed to rheumatic fever but including such relatively acute conditions as Still's Disease, is the cinderella of the medical schools. The student is taught little or nothing about the subject and probably sees no more than an occasional case of osteoarthritis treated with Scott's dressing in the out-patient department, or referred may be to the unknown limbo of the massage department. Consequently when he goes into practice and is confronted with numerous cases of crippling disease, he finds himself completely at sea, and a hurried recourse to the standard textbooks will probably do little to resolve his uncertainty. An obscure ætiology, a babel of classification, and a confused welter of "hot air and blue lights" by way of treatment, make him feel even less capable of approaching his cases than before.

There is, then, something to be said for a book written from a well-defined point of view. This short treatise is written on the theory that rheumatism is caused by bacteria usually regarded as purely commensal, and that the disease can in most cases be arrested by using vaccines of such organisms, mainly staphylococci and non-hæmolytic streptococci, obtained from the urine and elsewhere. The available experimental evidence for this view is well summarized, and, though by no means overwhelming, is certainly suggestive. It is surprising, however, to find no mention of diphtheroid bacilli which have frequently been isolated by other workers from urine, lymph-glands and even joint-effusions of rheumatic cases. Whatever the controversies about ætiology, H. Warren Crowe is principally concerned in advocating the value of vaccines as an empirical treatment for this group of diseases, and he claims to have obtained "benefit" in 85 per cent of his cases, in the majority with stock vaccines alone, and in the minority with autogenous vaccines from the patient's own flora. As his experience covers some 10,000 cases treated at the Charterhouse Rheumatism Clinic, it cannot be disregarded, and the care required in applying his technique explains easily why the method has come into disrepute. For vaccines are customarily injected into a patient with less attention than would be employed in putting grease into a motor car with a grease gun. H. Warren Crowe makes it clear that a proper understanding of the rationale and of the patient and his

reactions is essential to success. The more orthodox aspects of the subject are not neglected. There is an admirable summary and comparison of the various classifications, and the one he himself advocates is perhaps better than most. The chapters on X-ray treatment, laboratory technique, orthopædics and physiotherapy, each by an expert, though brief, are excellent. Finally, however agnostic one may be about the main thesis, one cannot afford to neglect it, this book can be recommended to those who may be in a state of confusion or despair over the conditions which fall into the wide field of the rheumatic diseases.

J. W. C.

THE MEDICAL ANNUAL. A Yearbook of Treatment and Practitioners' Index. Edited by H. Letheby Tidy, M.D., F.R.C.P., and A. Rendle Short, M.D., B.Sc., F.R.C.S. Fifty-seventh year. 1939. Pp. 660, Bristol: John Wright and Sons; London: Simpkin Marshall. Price 20s.

We look forward to the addition of the Medical Annual to our hospital reference libraries at home and abroad, for it is one of the means by which we are able to keep abreast of all aspects of medical science. The 1939 edition, the fifty-seventh year, contains a goodly list of special features, including as it does under Air Raid Precautions, some notes on first aid parties, requirements and personnel of first aid posts and accommodation for those injured during raids from the air. Traffic lights are considered to produce a collision of excitatory and inhibitory conditioned reflexes by reason of the uncertainty as to the moment of change and also by the suddenness of the change of colour. A more gradual method by which some warning is given of the colour change is suggested. Pneumatic drills began their life below ground in mines and, as the editors say in the preface, many people will wish they had stayed there. The effects caused by these public nuisances upon workers are discussed.

The year has been characterized by the reports upon the effectiveness of sulphonamides and M & B 693, and the Medical Annual gives an account of the diseases wherein almost miraculous results have been obtained by the use of these drugs. Professor R. St. A. Heathcote deals ably with the pharmacology of this group of drugs. In another section he also sounds a timely note of warning in the use of bromides; our textbooks teach us that bromism is evidenced by skin eruptions, but recent papers seem to show that these are in reality more rare than the effects of bromide intoxication on the central nervous system; in fact, excessive intake of bromides may cause a condition resembling a toxic psychosis and unless this fact is borne in mind, the patient may receive an increase in dose of bromide with the production of a serious and sometimes fatal result. The fact that cases of bromide intoxication do occur should not be used against

the use of bromide because the drug is a valuable one if used with care and discretion.

Maternity and Child Welfare are well reviewed by Ethel Cassie and those of us who find ourselves detailed for this work will find much help and advice in this section.

Dr. Gardiner Hill's article on sex hormone therapy helps to disperse the fog of confused nomenclature and makes the issue much clearer.

The pulmonary diseases have been summarized by M. Davidson in place of the late L. S. T. Burrell and it is suggested that "pneumonitis" should be used as a substitute for certain forms of pneumonia in which there is no rise in the respiration rate, resulting in a condition usually called unresolved pneumonia. The parts contributed by Manson-Bahr are well worth perusal because many important aspects of tropical diseases are dealt with by him, such as the Ascoli treatment of malaria, the vitamin B and nicotinic acid treatment of pellagra and amœbic invasion of the skin and subcutaneous tissues.

Among the legal decisions and enactments given by D. H. Kitchen will be found the present position of the tests for paternity, the law of therapeutic abortion, an important ruling regarding the leaving of a swab in the abdomen after an emergency operation, and in the matter of compensation, the answer to the question "is a hospital nurse a workman?" appears to be in the affirmative.

A full review of the insulin and cardiazol treatment of schizophrenia is given by Aubrey Lewis. The conclusions are necessarily guarded but it seems that the duration of many schizophrenic attacks has been shortened and that the earlier the patients receive the convulsant treatment the better are the results.

The surgical portion maintains its usual high standard but generally speaking there is little new to note.

Space forbids further mention of many other important features but in no other yearly publication is the field covered so wide. As usual the Annual has been carefully edited, the illustrations are excellent and considering the size of the work typographical errors are remarkably few.

The advertisements at the beginning tend to obscure the title-page, the list of contents and the names of those who have contributed, while those at the end make the location of the subject index rather difficult; perhaps, in future editions, coloured edges to advertisement pages would help to correct this fault. R. P.

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No. 5. November, 1939. Vol. LXXIII.

Journal

OF THE

Royal Army Medical Corps

ISSUED MONTHLY

IN ARDUIS FIDELIS

EDITOR.
COLONEL SIR WILLIAM H. HORROCKS, K.C.M.G., C.B.

MANAGER.
LIEUTENANT-COLONEL W. J. F. CRAIG, R.A.M.C.

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Price Two Shillings and Sixpence net

VOL. LXXIII. NOVEMBER, 1939. No. 5

Journal of the Royal Army Medical Corps.

Original Communications.

PREVENTIVE MEDICINE IN RELATION TO AVIATION.

BY AIR COMMODORE H. E. WHITTINGHAM, C.B.E., K.H.P., F.R.C.P.ED., D.P.H.

(*Continued from page* 228.)

II.—THE PROTECTION OF FLYING PERSONNEL AGAINST DISEASES DUE TO FLYING.

THE safe piloting of aircraft under all conditions of weather, especially while landing and taking-off and during the performance of aerobatics at high speed, necessitates that pilots should possess a high degree of physical fitness. In the Service all flying personnel—pilots, observers, air-gunners, photographers and wireless operators—should be alert in body and mind, with good muscle tone and quick reaction time, and should possess as well accurate vision and a good sense of balance. For these reasons, there is a continual endeavour on the part of the medical branch, working in close co-operation with aircraft constructors and various research workers, to improve any conditions of flying, whether connected with the aeroplane flying equipment or man himself, which are proving detrimental to the well-being and efficiency of the personnel. In this connexion there have been many problems to solve concerning glare, ocular fatigue, blacking-out, noise, excessive vestibular stimulation, oxygen want, mental and physical fatigue, and air-sickness.

Vision.

As regards affections of the eyes due to flying, the problems of counteracting glare, the ocular fatigue of night and blind flying, and blacking-out, arise.

20

Glare is specially liable to affect the eyes of aviators when engaged in flying over clouds, desert, or water, also when flying towards the sun or when looking towards the sun in aerial warfare, real or mimic. Wing Commander P. C. Livingston, from 1930 to 1938, has done much valuable research on glare and its prevention, and, as a result, has been mainly responsible for the design and perfection of the present-day flying goggles and glasses, which give a full field of vision both in front and laterally as well as permitting binocular vision while landing—these were defects in previous designs. These goggles have been specially designed to fit and remain fixed at any speed to the flying helmet complete with oxygen mask, and to allow of immediate and easy adjustment to any desired position, as well as any width of nose. They are so constructed that triplex glass filters of various tints, appropriate for day or night flying, or suitable lenses for visual correction, can be instantaneously slipped in as required while flying. In addition, there is a dark visor which can be tilted into position in front of the goggles to enable the pilot to fly, or the air-gunner to take aim, if necessary, direct towards the sun with the minimum of glare effect. The antiglare value of these flying glasses has been highly spoken of by members of the long-distance flights in Vickers-Wellesley bombers, which took place to Egypt, via the Persian Gulf, early this year, and to Australia on last month's record-breaking flight. Recently, glasses have been made containing spluttered platinum or aluminium which, by their high refractive power, materially decrease glare and heat from the sun and at the same time give improved visual definition.

Ocular fatigue occurs during night or blind flying and is due to the rapid to-and-fro movements of the eyes while observing the various instruments on the illuminated instrument board. This has been overcome by a practical placing and grouping of instruments so that those most frequently looked at are concentrated in the line of vision. In addition, a weak plus lens is provided for insertion in the flying goggles or glasses for magnifying purposes, and any individual refraction errors are corrected.

Blacking-out.—Another problem which concerns both ophthalmologist and physiologist is that of *blacking-out*, a condition first encountered by aviators during the period of training for the Schneider Trophy race in 1929, at the time when aeroplanes had developed sufficient speed to produce centrifugal forces greater than 4 'g' while performing sharp turns. It also occurs when an aeroplane is being pulled out from a steep dive at high speed; the sharper the turn, provided the speed is kept constant, the greater is the centrifugal force and its effect on the human body. The onset of blacking-out is sudden, but it does not occur immediately an excess over 4 'g' is applied, as there is a period of delay lasting a variable number of seconds, depending on such factors as the amount

of 'g' applied, the general physical and vasomotor tone of the person concerned, and the anticipation of or unpreparedness for the manœuvre performed (*see* diagram II).

The main effects of high 'g' on a healthy man are, first a feeling of being forcibly pressed into the seat of the aeroplane, then of the abdominal contents being displaced downwards; this is quickly followed by a gradually increasing dimness of the whole visual field, then sudden blindness or

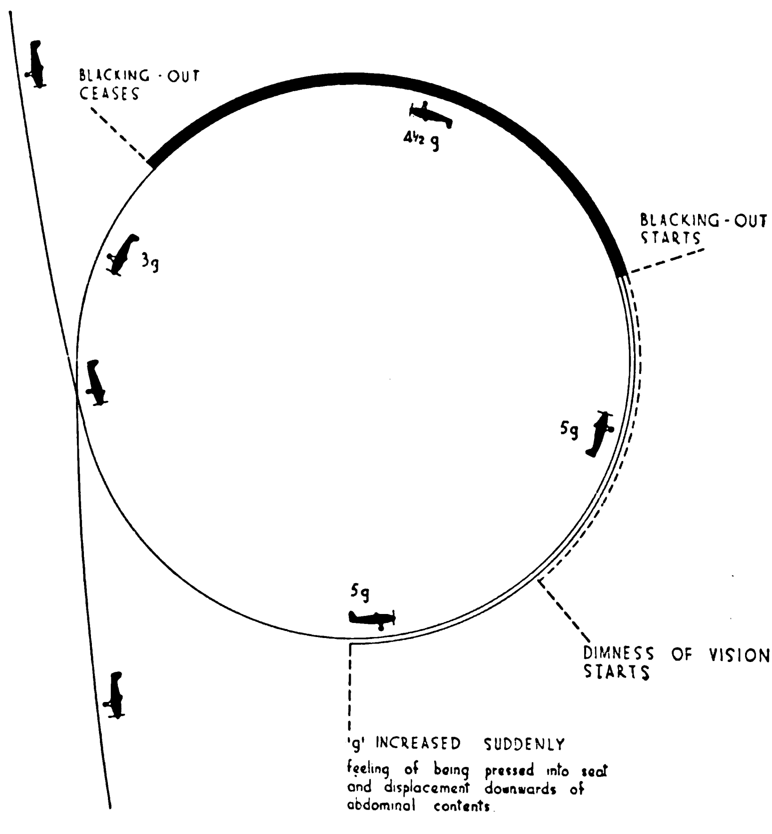

DIAGRAM II.—Diagrammatic representation of the process of blacking-out occurring during a steep dive or turn in aircraft at high speed.

"blacking-out" occurs, but consciousness is retained, except in highly susceptible persons such as those with poor cardiovascular tone. The blacking-out period lasts a varying length of time, usually about two to five seconds, depending on the force and duration of the 'g' applied; it passes off as suddenly as it occurs while the loop or turn is being completed at a force less than 4 'g'. There may be a certain lack of mental concentration for a few hours subsequent to a blacking-out, but in the trained and fit pilot blacking-out does not occur readily and after-effects are not

evident. The great danger of blacking-out is the momentary loss of control of the machine, which is liable to cause a collision with a neighbouring aeroplane during formation flying and tactics which are the order of the day.

To prevent or ameliorate this condition it is first necessary to understand the cause. In this connection a considerable amount of research work has already been done, especially in Germany, and more recently in this country by Wing Commander H. W. Corner and Flight Lieutenants J. B. Wallace and D. J. Dawson in high-speed aircraft. From these researches it would appear that the centrifugal force, acting from head to feet, causes most of the blood to flow in that direction, producing splanchnic pooling and increased volume of the lower limbs, as demonstrated by means of X-rays on monkeys by Fischer (1937). Thus, the head and heart are drained of much blood during the application of high 'g,' leading to a fall of the systolic blood-pressure, as shown by Ruff (1938) in Germany, by means of a centrifuge, and by Corner (1938) in this country in high-speed aircraft. This lowering of the blood-pressure reduces the pressure in the central artery of the retina, which is normally about half that in the brachial artery (Magitot and Bailliart, 1922), to such a degree (Andina, 1937) that the balance between intra-ocular and vascular pressure is upset and as a consequence the circulation of blood in the central artery of the retina is stopped, and thus causes complete blacking-out of vision until the said balance is readjusted by the return of the normal blood-pressure, when the centrifugal force falls below 4 'g.' At forces of less than 4 'g' the action of the carotid sinus reflex is sufficient, apparently, to prevent the blood-pressure falling low enough to cause blacking-out, as shown on dogs by Koenen and Ranke (1937).

Preventive measures were introduced first by the personal experience of pilots, who found that a certain amount of relief was to be obtained by yelling loudly during a steep turn or sharp pull-out, so as to contract the muscles of the abdominal wall and raise the diaphragm. This procedure brings to mind the observations of Flack and Bowdler (1920), who advocated that aviators should keep themselves physically fit and practise exercises to develop and maintain a firm abdominal wall. All flying personnel should keep physically fit, as this is a simple and effective means of lessening the ill-effects of high 'g.' The natural sequence of thought led to the trial of various types of belt to give increased support to the abdominal wall and so lessen splanchnic pooling. Flack (1929) provided members of the British Schneider Trophy team with a simple elastic belt, but this was soon discarded as being useless. Group Captain G. S. Marshall (1933) suggested the use of a safety-belt fitted with a spring-loaded scoop to inflate the belt with air under pressure of high 'g', but its production has been delayed until recently. Flight Lieutenant J. B. Wallace carried out several

experiments at North Weald in 1937 and 1938 with a specially designed abdominal belt fitted with a pneumatic bag to increase the pressure on the abdomen, and he found that it helped to prevent or delay the onset of blacking-out up to a force of 6 'g' in some individuals; whereas Ruff (1938) in Germany, did not consider that abdominal belts were very successful in counteracting the centrifugal movement of blood to the dependent parts of the body. Instead, he suggested a form of folding chair, so designed as to bring the bodies of pilot or crew into a crouching position, so that the chest is pressed horizontally against the upper thighs, while the lower legs are drawn in under the thighs, as was recommended by von Diringshofen (1934 and 1936), at one time a German war pilot, after he had shown the benefit of this crouching attitude with regard to the higher endurance of powerful centrifugal forces; this procedure materially reduces the difference in height between brain and heart, and so alters the axis of the body exposed to the centrifugal force that a sufficient blood volume is retained in the head and heart to prevent the occurrence of blacking-out. Wing Commander P. C. Livingston has suggested that the seat should be provided with an oleo fitting so that the first intense force could be dispelled by the seat sinking away as the gravity factor comes on, and thus, by neutralizing the effect of 1 or 2 'g' in this manner, no ill-effects might be felt as the result of a 5 'g' manœuvre. Flight Lieutenant J. B. Wallace (1938) proved that the administration of oxygen does not delay or prevent the onset of blacking-out; while Ruff (1938) showed that the administration of carbon dioxide raised the limit of endurance to centrifugalization.

Night blindness of mild degree is found occasionally in aviators, who not only find difficulty in seeing in the dark, but have a delayed visual adaptation rate when looking from a lighted area into the dark, for example looking from the illuminated cockpit to outer darkness or landing at night with flares. Squadron Leader J. C. Neely is at present investigating this subject with special reference to its incidence among flying personnel and its amelioration by the administration of vitamin A, which apparently plays an important part in the regeneration of the visual purple as shown by Mutch and Griffiths (1937), Maitra and Harris (1937), and Haines (1938).

A good eye lotion has been found very useful in relieving the tiredness of eyes during long flights.

Hearing.

Noise in aeroplanes is mainly derived from engine explosions, from revolution of crankshaft and propeller, and from aerodynamic turbulence; this noise is greatest near the engine and is radiated in closed machines from walls, floor, and roof, but not in equal degree; thus radiation is greatest below the front windows and noise is least in the centre of the cabin.

The effect of noise on man depends on its level in the sound scale.

Sounds between 80 and 90 decibels are disturbing, the degree depending on individual sensitivity; whereas sounds above 90 decibels are deafening, the more so as the scale is ascended, and at or above 120 decibels they produce the feeling of pain. Continued exposure of the unprotected ears to sounds above 80 decibels will eventually lead to various degrees of nerve deafness: such deafness would be occupational, leading to claims for attributability, except that all Service pilots are provided with special ear-pads to exclude noise, the onus to wear them being on each individual who enters Service machines. The progressive deterioration of auditory acuity in pilots, who have flown over a hundred hours without wearing ear-pads, has been demonstrated by Wing Commander E. D. D. Dickson (1938). Noise also leads to fatigue.

Examples of sound values.

80 to 90 decibels: Police whistle at 15 ft.; motor horn at 23 ft.; fire syren at 75 ft.

90 to 100 decibels: Pneumatic drill at 10 ft.; newspaper press room; inside cabin of aeroplane not sound-proofed.

100 to 110 decibels: Boiler shop; whistle of steam engine; steel riveting machine at 15 ft.

110 to 120 decibels (this is the threshold of painful feeling): Thunder (overhead); heavy gun-fire (close proximity to); unmuffled aeroplane engine (close proximity to).

In the non-sound-proofed cabin aeroplane there is noise between 90 to 100 decibels in intensity. Aeroplane constructors, both in Europe and America, including Dryden (1930), Spain, Loye and Templin (1936), have studied the problem of the reduction of aeroplane noise and vibration and, as a result of the insulation of walls against sound and the provision of internal surfaces that give good sound absorption, noise has been so decreased that conversation in an air liner of to-day is as easy as in a modern train.

In Service machines it is not practicable to reduce noise in this manner, owing to the question of weight. Instead, special ear-pads are provided as part of the flying helmet, at any rate for pilot, navigator, and wireless operator; whereas, other occupants of the 'plane, e.g. personnel being transported in troop-carriers, usually just plug the external auditory meatus with cotton-wool. This latter procedure does not prevent the conduction of a certain amount of noise, both by air and by bone conduction; the wearing of a flying helmet, if strapped under the chin, lessens this conduction.

Telephony between pilots and other members of crews in Service aircraft raises another problem of preventive medicine. The continued presence of a microphone in front of the mouth is annoying and therefore helps to hasten the onset of fatigue. Conduction of voice sounds by means

of a microphone fixed either over the larynx or sternum has been tried, but, so far, the results have been poor owing to distortion of voice sounds and absence of labial sounds.

Wing Commander E. D. D. Dickson is at present working in conjunction with Dr. A. W. G. Ewing of Victoria University, Manchester, and the Air Ministry Research Staff at Farnborough, to eliminate the effect of aeroplane noise on the ear and to perfect, if practicable, voice transmission and reception by bone conduction by means of a moving-coil microphone fitted over the sternum and an oscillator applied to the region of the mastoid process or over the brow while the external auditory meatuses are occluded.

Middle-ear deafness and excessive vestibular stimulation have also to be guarded against while flying. During steep and long ascents and descents, the balance of air pressure on the two sides of the tympanic membrane is so affected, especially by very rapid descents, that it is necessary to open the Eustachian tubes frequently by swallowing, aided perhaps by chewing gum, or forced blowing against the closed nostrils, so as to readjust the pressure to that of the atmosphere, otherwise tinnitus aurium, deafness, pain in the ears, or vertigo, result. Flying personnel should not be permitted to fly while suffering from cold in the head, owing to the danger of mucus or swollen mucous membrane occluding the Eustachian tubes and thus preventing the normal adjustment of the intra- and extra-tympanic pressures. Rapid descents, while there is obstruction of one or both Eustachian tubes, will either cause rupture of the ear-drum or excessive vestibular stimulation, leading to vertigo and vomiting with the possibility of serious consequences.

Respiration.

Oxygen want or anoxæmia in altitude flying has been dealt with in considerable detail by various medical officers who served in the R.A.F. during the Great War, namely by Birley, Dreyer, Corbett, Bazett, Flack and Heald (1918), and their articles were revised and published in the Medical Research Council's Special Report, Series No. 53, in 1920. Group Captain G. S. Marshall (1933 and 1937) has brought the subject up to date in connexion with modern high-altitude flying. It has been proved that in the fit individual, as far as aviation is concerned, symptoms of oxygen want, such as dulling of the judgment and intellect, unwarranted sense of well-being and security, delayed reaction time, dyspnœa, and muscle weakness, do not usually occur until the height of 15,000 ft. has been reached and then only after the occupants of the aircraft have been at that height for about half an hour, though the time period varies greatly with apparently normal persons; of course, the symptoms occur much quicker if moderate exercise, such as air gunnery, is indulged in.

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Experiments in the decompression chamber have confirmed experience in the air and have shown that at 20,000 to 25,000 ft. without oxygen definite respiratory distress occurs rapidly as the result of such movements as operating a machine gun; heights above 25,000 ft. cannot be attained without the use of oxygen, as unconsciousness and death would quickly occur, owing to the low percentage of oxygen in the blood and tissues.

TABLE II.

Height above sea-level (feet)	Partial pressure of oxygen in inspired air (mm. of Hg)		Partial pressure of oxygen in alveolar air (mm. of Hg.)	Oxygen saturation of the blood in normal persons (percentage)
	Dry	*Wet*		
0	160	151	98	96
15,000	90	81	50	82
20,000	73	64	36	63
25,000	59	50	30*	50*
30,000	47	38	pressure at this altitude is insufficient to support life	

* Presumed figures.

R.A.F. personnel are not permitted to fly at heights above 16,000 ft. without the use of oxygen, as man's mental and physical output is definitely reduced at this height, and correspondingly more so as greater heights are attained. Even at much lower altitudes, during long flights such as patrols, the administration of oxygen diminishes or abolishes the fatigue or staleness and increases the mental alertness and muscular vigour of the aviator, as was shown by Flack and Heald (1917 and published 1918). These important facts should be impressed on flying personnel, especially in war time, when the keenest judgment is needed on all occasions.

The present policy is to supply an increased percentage of oxygen in the inspired air for flights at heights between 16,000 and 35,000 ft., and for this purpose oxygen masks are fitted to all Service flying helmets and connected by suitable tubing to an oxygen cylinder so that each individual can turn on his oxygen supply as required; the oxygen flows constantly and mixes with inspired air in the mask, two-thirds being always lost as inspiration occupies only one-third of the respiratory cycle. Further research is now being planned to improve, if practicable, the present wasteful method of giving oxygen. For altitude flying above 35,000 ft. it is usual to supply pure oxygen under a pressure of 130 mm. of mercury to an individual enclosed in an airtight pressure suit somewhat resembling that of a diver (Marshall 1933); in this manner Flight Lieutenant M. J. Adams, in June 1937, reached an altitude of 54,000 ft., a record only recently broken by the Italian, Colonel Pezzi, when he reached 56,000 ft. in October 1938.

Fatigue.

Fatigue in aircraft crews, leading to diminished work performance, was dealt with by Air Commodore A. V. J. Richardson (1935) in his

presidential address to this Section. He drew attention to the nervous exhaustion resulting from the cumulative effects of daily fatigue, which causes a continual drain of nervous energy, so that day after day the individual becomes less refreshed by sleep and less fitted for work; this is apt to lead to psychological trouble. As regards aviation, there are various factors at work in causing fatigue, such as the stress of taking-off and landing at high speed, the mental anxiety of night flying or flying through cloud and fog, the discomfort of a confined and cramped position, vitality lowered through cold and draughts, the effect of noise on the auditory nerve, anoxæmia at higher altitudes, and the injurious effects of carbon monoxide if fumes enter the cockpit or cabin.

Preventive measures to combat these fatigue-producing factors have been conducted along the following lines. Robot-pilots, artificial horizon, aerial compass, and wireless, have done much to simplify night and blind flying. Attention to the design and positioning of seats has overcome cramping, especially in civil passenger aeroplanes. Air-conditioning of air liners has provided an agreeable temperature in the various compartments in all climates, without draught; owing to undesirable extra weight, this has not been found practicable in Service machines as yet, but for everyday flying in this country a special flying suit, consisting of a linen fabric outer cover, waterproofed inside and lined first with linen fabric, then with wool, has been provided, together with a lambskin collar, dyed nutria, but free from phenylene diamine, which is apt to cause dermatitis. In addition, there are flying boots and flying gloves; the latter consist of three glove layers, the inner of silk, the second of cotton, and the outer of leather, to suit varying temperature conditions and permit of adequate cleaning. Of equal importance is the provision at all squadrons of well-ventilated drying rooms to ensure that flying kit is dry and warm before being put on. A so-called "thermally insulated" suit, consisting of leather outside, lined with a heavy sheepskin inside, is issued for conditions of extreme cold. Sound-proofing in air liners and the provision of special ear-pads in Service machines, as already described, have largely overcome the noise factor. Oxygen is provided to counteract anoxæmia, as already described. Attention to the positioning of the exhaust has done much to overcome the fume nuisance, though the occurrence of persistent headache, not relieved by aspirin, in closed machines on long flights, suggests the possibility of carbon monoxide poisoning in mild degree: this requires further investigation.

Digestion.

Ballooning of the stomach or intestines, due to expansion of the contained gases, tends to occur at high altitudes, especially in those who have lax abdominal walls and suffer from fermentative indigestion: this is increased by a too-liberal carbohydrate diet. The ballooning may seriously

embarrass the heart and respiration. Relief may be obtained by proper dieting before flights and by the administration of hydrochloric acid mixture during meals to aid digestion as the hydrochloric acid content of the gastric juices is often low in such cases.

Diet of persons on long-distance flights has been experimented with, chiefly by means of trial and error, on the various long-distance flights, and one consisting mainly of carbohydrates has been found to be the most suitable, as muscular movements and exercise during flight are very limited and the main requirements are to maintain bodily heat and energy; in fact, as the flight progresses, especially in warm climates, it is found that the appetite is materially decreased. Table III shows a suitable flying ration for one person for a three-days flight.

TABLE III.

Item	Quantity
Dried meat (e.g. pemmican or biltong)	2 lb.
Sandwiches, whole round	6 lb.
Chocolate, milk or plain	¼ lb.
Oranges (bottled fresh juice)	12
Apples	6
Bananas	6
Dried dates	¾ lb.
Dried figs	¾ lb.
Dried raisins	¾ lb.
Sugar, lump	¼ lb.
Sugar, barley	¼ lb.
Chewing gum	¼ lb.
Coffee, black, unsweetened	1 gallon
Malted milk tablets	¼ lb.

In addition a bottle of glyco-thymoline, diluted 1 : 10, to rinse out mouth to lessen dryness.

Water is provided on desert flights on the assumption that it may be required for a minimum period of three days in case of forced landings. For this purpose water is carried on the scale of one gallon per man per day, that is, a quart in each water bottle, the rest being stored in tanks and, as already mentioned, these tanks require special treatment in cholera-infected areas.

In addition, for detached aircraft on flights abroad, a small meta-filter, complete with semi-rotary pump and 30 ft. of tubing, weighing 23 lb. in all, is supplied, together with sufficient bleach and ammonia to chloraminate the water filtered by means of this pump. For detached squadrons a small motor-driven plant for mechanically chloraminating water is provided, the whole apparatus packs neatly into two cases, each case being a 2-ft. cube and weighing 150 lb., so that it can be readily transported by aeroplane, motor car, or motor boat; the apparatus can be assembled for action within fifteen minutes and is capable of delivering 250 gallons of filtered, sterilized water an hour. One or more collapsible "sportapool" tanks complete the equipment.

Air-sickness, like sea-sickness, is considered by most authorities to be due to the abnormal excitation of highly sensitive vestibules leading to vagosympathetic disturbance and hypertonus of the stomach, as shown by Gwynne Maitland (1931) and Flack (1931). Liability to this condition can be assessed in the medical room by the type of response to spinning in the Bárány chair. By repeated exposure to these abnormal stimuli the vestibule becomes adapted to them, as far as flying is concerned, at least in a certain number of cases. Wing Commander E. D. D. Dickson thinks that the adaptation rate is as high as 80 per cent. On these grounds it is intended, as a temporary measure, to accept a limited number of candidates who show varying degrees of air-sickness and to send them to a particular flying training school, where they will receive a special course of training. There are other means of educating the vestibules to adapt themselves to aerobatics; thus in Russia and Germany use is made of rotating wheels. In addition, there are the usual aids for the "bad sailor," that is, drugs of the barbiturate group, which act as sedatives on the nervous system and reduce muscle tone, including that of the stomach, but which, unfortunately, cause an uncomfortable dryness of the mouth. These remedies must, of course be taken about half an hour before the intended flight and may require to be repeated during long flights.

As regards flying in warm climates, aluminium fabric sunproof blinds have been fitted in the roof of the cockpit of certain Vickers-Wellesley bombers and have proved of practical value as a protection from the sun; and at the present time the flying-helmet is being reconstructed so that it can be used in two layers, a light inner webbing layer for use in the tropics and in closed-cabin aircraft, over which can be worn a thick outer layer for use in open aircraft and under conditions of cold.

In conclusion, I wish to express my deep gratitude to the Ministry of Health, particularly to Drs. T. Carnwath, P. G. Stock, and M. T. Morgan, for their courtesy in inviting me to various departmental meetings dealing with aviation and general public health matters; to Imperial Airways, especially to Colonels H. Burchall and F. P. Mackie, for their ever-ready help, information, and co-operation on many occasions; and to the various R.A.F. medical officers who have permitted me to refer to their researches, some of which have not been published as yet.

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MEDICAL PROBLEMS OF AVIATION.

By E. JOKL, M.D.—A Pilot.

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I.—Reflex Responses at High Altitudes.
(With Diagrammatic Table.)

Technical developments have enabled modern aircraft to fly at sub-stratospheric altitudes. Thus, rough and bumpy air conditions and other adverse circumstances such as prevail at moderate flight levels can be eliminated, and as it is possible to provide for a constant supply of oxygen at practically any altitude, it is obvious that the substratosphere is the long-distance flying space of the future. The cabin will be "sealed off" at an altitude of 8,000 feet and a constant pressure corresponding to sea level atmospheric conditions will be artificially maintained. It is now generally accepted that "the major unsolved problems of aviation are physiological rather than engineering in nature," and that aviation medical research is "in a primitive state as compared with the advanced stage which aeronautical engineering has reached" (Dill, 1938). It is only recently that the study of aviation medicine has been given sufficient consideration, and that the medical profession has recognized this branch of medical sciences (Jokl, 1936). The problem of the effects of high altitude upon the aviator requires an entirely new analytical approach. Most of the older experiences, collected during high mountain expeditions, cannot be utilized as the acclimatization factor is always involved in the course of slow climbing, while modern aircraft ascends to altitudinous levels in such short periods of time that the well-known processes of true acclimatization do not take place. In addition, it must be realized that the altitudes reached by aircraft are much higher than the uppermost levels conquered by mountain expeditions.

In this paper attention will be drawn to an observation which has to some extent been instrumental in initiating a systematic physiological analysis of certain neurological aspects of high altitude flying.

Reflex Responses.

In 1932 I was impressed by an interesting experimental observation which appeared to me to be of importance in the study of the physiology of high altitude. When testing tendon and periosteal reflexes of rabbits before and after subjection to low atmospheric pressure, I found that there occurred a marked diminution of the reflex responses, whereas at greater "altitudes" there was an exaggeration of these responses. At the Davos Research Institute I investigated this interesting bi-phasic phenomenon and found it to be present in normal animals as well as after complete transection of the lower cervical or of the upper thoracic spinal cord. I observed that whether the secondary increase of reflex response occurs at a lower or higher level during the "ascent" depends upon the rate at

which the pressure is lowered. Thus, if the "ascent" is hurried, the second phase, that of increase of reflex activity, occurs sooner.

At this time, I communicated to Professor Loewy my observations and suggested an investigation on human beings. As there was no pressure chamber available at Davos suitable for such experiments, it was decided to organize two mountain expeditions, one to Weissfluhjoch (2,450 metres) in Graubunden and a second to Muottas Murail (2,650 metres) in the Engadin. Eight experimental subjects ranging from sixteen to seventy-three years of age took part in these expeditions. The results, published in 1933 in the *Zeitschrift f. d. ges. Neurologie*, showed that at these altitudes, corresponding to the pressures of the first phase of my animal experiments, there occurred a diminution of all deep reflex responses. This paper which to my knowledge broached this question for the first time, has since been followed by a number of publications on the subject which is now being studied in great detail by the Research Department of the German Air Ministry (Treutler, 1937 ; Landscheck, 1938 ; Strughold, 1939).

In 1934, Wespi published a paper in which he reported on what he believed to be a repetition of my investigation. However, instead of following the method used in my experiments, Wespi utilized a low pressure chamber producing simulated altitudes of between 10,000 and 16,000 feet. He found only the second phase of reflex response to altitude, that of increase, and missed the phase of diminution of reflex response, because he failed to observe the reflexes at the lower altitude.

I originally intended to repeat my tests at still higher mountain stations, and on two occasions discussed with Professor Loewy the question of organizing expeditions to the Jungfraujoch and to the Capanna Margerita. Professor Loewy also suggested my going with the Himalaya expedition, which at that time was being prepared by Merkl. However, circumstances made it impossible to carry out this plan.

Treutler (1937), Landscheck (1938) and Strughold (1939), using automatically recording apparatus for their investigations of the patellar reflex response, have now fully confirmed my original observations. They point out that commencing at an altitude of 2,000 metres (6,600 feet) there is a marked decrease of reflex response, which diminution is sustained until an altitude of about 4,500 to 5,000 metres (14,000 to 16,000 feet) has been reached, when, if the ascent is continued, a marked increase of reflex activity then occurs.

It appears that 5,000 metres is a critical level and there is reason to believe that the increase of reflex response above this level is an early indication of oxygen lack of the central nervous system. From animal experiments as well as from aviation experience, it is now known that a second critical level exists at an altitude of approximately 8,800 metres (29,000 feet) above which loss of consciousness, muscular cramps, paralysis and even death occur. In other words, the study of nervous reflexes under high altitude conditions has brought to light the fact that with increasing lack of oxygen one can distinguish five zones of functional response of the nervous system.

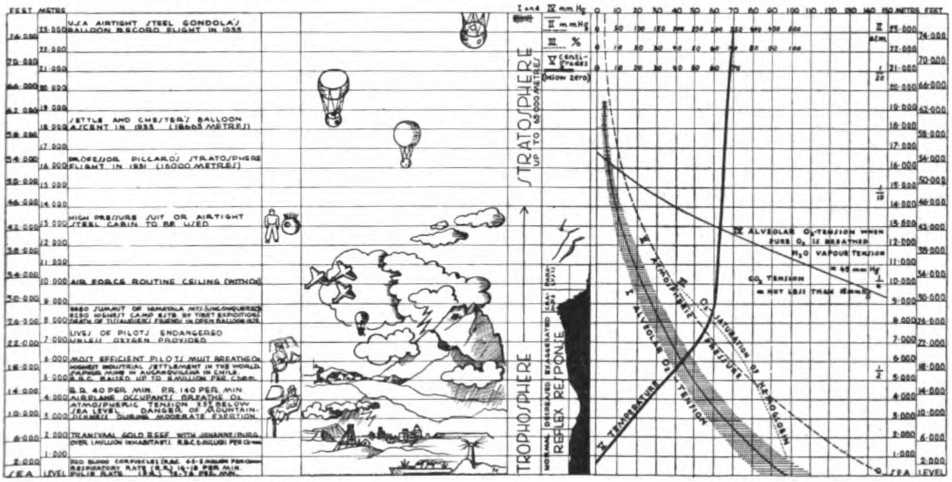
(1) 0 to 2,000 metres: The zone of normal reflexes.

(2) 2,000 to 4,500 metres: The zone of diminution of reflexes apparently indicating adaptation to altitude.

(3) 4,500 to 8,800 metres: The zone of increase of reflexes, indicating early disturbance of nervous control.

(4) Above 8,800 metres: The zone of cramps, indicating serious impairment of central nervous function.

(5) The zone of paralysis followed by death.



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II.—THE ANOXÆMIC OXYGEN COLLAPSE.

There are few, if any, situations in which a greater oxygen debt has been incurred than after races over a quarter a mile, half mile, or, most of all, after quarter mile hurdle races. Between 1928 and 1936 I observed and subsequently described several cases of outstanding athletes who became unconscious after the conclusion of such competitive performances (1933, 1936). I considered the possibility of the peculiar physiological situation resulting from the acute change from the state of extreme oxygen want during the final phase of the races to a condition of full oxygen supply suddenly being restored after the running, being responsible for the occurrence of the circulatory disturbances (Jokl, 1935*a*). The same mechanism may possibly explain the observations made as early as 1899

by Mosso when he noted that marked anoxæmia leads to increased liability of the vasomotor system and that acute collapses not infrequently follow physical exertion on high mountains. Some years ago I drew attention for the first time to the fact that after strenuous races at sea level athletes often experience peculiar symptoms, such as giddiness and the sudden appearance of short-lasting scotomata, i.e. signs which are indicative of an advanced state of anoxæmia (1930). Seven years later G. N. Humphreys, writing in Ruttledge's classic Everest report (1937) described analagous symptoms observed in the highly-trained members of the expedition produced by exertion at high altitudes, for example, when steps were being cut up the North Col.

My original observations of this type of collapse (*see also* 1935*b*) as well as their interpretation are supported by reports given by air-pilots to the effect that severe disturbances, even unconsciousness, occur when breathing of oxygen is commenced only or resumed after temporary interruption, at high altitudes. It is quite possible that a number of hitherto unexplained high altitude collapses like that experienced by Major Schroeder, of the American Army Air Service, during his record flight in 1920, thus find an explanation. Schwarz and Malikosis (1938) described the case of a pilot, who having interrupted his artificial oxygen supply in order to attend to a mechanical defect of the engine at an altitude of 20,000 feet, collapsed unconscious in his seat when he resumed breathing oxygen. The same authors have subsequently investigated the effects of oxygen on individuals subjected to low pressures in the experimental steel chamber. If the breathing of oxygen was commenced when simulated altitudes of over 15,000 feet had been reached, there occurred a sudden drop of systolic and diastolic blood-pressure, slowing of pulse-rate, and signs indicative of involvement of the central nervous system, such as clonic muscle cramps, tremor, lack of mental determination, deterioration of logical thinking, and ultimately syncope. These untoward effects were found to be particularly marked at very high "altitudes," especially if the subject had performed muscular work, or if he had been standing erect previous to the administration of oxygen.

The practical conclusion for aviation is that should oxygen be administered, this should be done at comparatively low altitudes before any hypoxæmic manifestations have appeared.

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AMNESIA.

By Major R. J. ROSIE,
Royal Army Medical Corps.

Amnesia or loss of memory is a symptom met with quite frequently in the Army. Many causative factors may underlie the production of this, but here only that amnesia which is retrograde in type and where the consciousness is not deeply clouded will be considered. During the war amnesia following periods of great stress was not uncommon. The only certain way for the affected individual to blot out the painful experience was by forgetting all other experiences which had occurred at that time. The resulting loss of memory might cover any period of time either before or after the event and might extend so far back that he had no memory of his past life and had lost his own identity.

During the past year three patients with complete amnesia for their past life, and with loss of their personal identity, have been admitted to "D" Block, Royal Victoria Hospital, Netley. Periods of amnesia of shorter duration and short amnesic fugues occur quite often among soldiers, probably more frequently than among civilians. The following illustrates a typical case of the latter variety.

Case 1.—Trooper A., of good physique and of at least average intelligence enlisted following a period of unemployment and against the wishes of his mother. He intended to join the R.A.M.C., but, in view of his physique and build, was advised to enter the cavalry, which he did. From the start he was afraid in the riding school. In May, 1938, he had a fall causing injury to his wrist. His parents were at this time in poor financial circumstances and he was much worried over his inability to assist them. He lived for some time under stress as he feared and disliked riding. Finally the fear became so intense that he deserted on December 11, 1938, but was afraid to return home. Eventually he did so on January 16, 1939, but left again next morning after a tearful parting from his mother who advised him to return to his unit. He then remembered nothing more until he found himself in a civilian hospital on the evening of January 20. He knew his name but was unable to give any account of his past life. In response to urgent questioning he regained all past memories with the exception of the period from January 17 to 20. There was no history of previous amnesic episodes. He was a reserved emotional individual whose day dreams played an important part in his mental life.

The psychogenesis of this case is clear. A hysterical fugue of this

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The psychogenesis of this case is clear. A hysterical fugue of this

nature frequently serves as a means of avoiding some difficult situation. In such cases when the memory returns it often does so completely, though there may remain a blotting out of memory for a short period which may never be recalled. Such cases are often reported in newspapers as they are frequently found wandering in some public place.

Case 2 presents an amnesia for the entire past life up to a recent period and with loss of personal identity.

Serjeant D., aged 32, when awakened on the morning of January 18, 1939, appeared to be distressed and stated that he could not remember who and where he was and could not recall his past life. He was admitted to the nearest military hospital where no organic cause that could account for his condition was discovered. He was visited by relatives and friends, but could not recognize either them or photographs of his parents and home surroundings. When transferred to "D" Block on February 18, he still showed a complete amnesia for his life up to January 18, 1939. The amnesia was retrograde and did not include events that had happened after January 18, 1939, and his general fund of information of current events was good. He was anxious and apprehensive, and fully realized the seriousness of his position with its possible adverse effects upon his career, which had previously been one of considerable promise. He was described as a conscientious hard-working man, but no information could be obtained from relatives or friends with any bearing on the case.

Word association tests and subsequent urgent questioning were tried, but, although the association times were all longer than normal, none was especially so, and no past memories were recalled by this means. Dream analysis helped slightly towards an understanding of the precipitating factor of his amnesia. On February 24 he was placed in a hypnoidal state, and, while in this, he described a dream in which he found himself trapped in a deep dark pit. He was struggling to reach the top, but was prevented from doing so by a man who I shall call Mr. A. When asked in the trance state to give further information about Mr. A. he manifested great emotional tension and stated that he could not do so. When awakened he was again questioned about this man, but denied firmly that he knew anything about him. On February 26 he was again placed in a hypnoidal state and described a dream in which he was walking, distressed and helpless over an apparently endless desert. He spoke and acted as if he was under the influence of some strong emotion. On February 28, he was more deeply hypnotized and then proceeded to give a complete account of his past life up to early childhood. For reasons of confidence the distressing and unfortunate situation in which he had been placed by Mr. A. cannot be described. His memories of this were charged with strong emotion. After he had talked for one hour he was given the post-hypnotic suggestion that he would remember all that he had told me and

would continue to remember it. He was then awakened but remembered nothing of what had taken place during hypnosis, but, when the post-hypnotic suggestion was repeated five minutes later, he became distressed and emotional and recalled everything. While in the hypnotic state it had been suggested to him that there was no necessity to have been so distressed and that there were other means of escape from his predicament. He appeared to accept this, for, quite apart from the abolition of his amnesia, he later viewed his difficult position in a calm and reasonable frame of mind, and left hospital apparently cured.

Case 3.—Private C., aged 25, stationed in India was noticed by his comrades to be rather strange in behaviour on October 16, 1937. He told them that he felt ill and did not know his name. He was described by them as a dull, quiet, nervous type of man and a teetotaller. When admitted to hospital he stated that he had lost all memory of his past life. He was unable to read or write as he could not remember the letters of the alphabet. On admission to "D" Block on February 26, 1938, he still maintained a complete amnesia for all events prior to October 16, 1937, though events since that date were well remembered. By this time he had been taught how to print the alphabet, but fellow patients had to read to him his letters from home. His mother visited him in hospital, but, much to her distress, he did not recognize her. She was unable to give any information bearing on the case, and inquiry into the family history did not reveal any psychopathic tendencies. The patient was depressed, anxious and worried about his condition. Simulation was suspected, but, though kept under careful observation for ten weeks, he did not at any time expose himself and the amnesia remained clear-cut and unchanged. He did not respond to any form of psychotherapy, and countered all questions with either "I don't know" or "my friends have told me so." Eventually he was invalided from the Service with a diagnosis of hysteria. Inquiry some months later showed that his memory had slowly returned after his arrival home.

There may have been an initial simulation in this case, but the maintenance and persistence of the condition was, I think, out of all proportion to the eventual gain. The persistence of an anxious apprehensive state while in hospital, and the slow recovery after return to his home are in favour of the condition having been hysterical. He showed no jubilation on stepping out of hospital dressed in civilian clothing.

Case 4.—Private F., aged 21, left barracks on the morning of January 7, 1938, on week-end pass, and was found by the police wandering in London that night and unable to give any account of his past. He was admitted to a civilian hospital, where he remained until January 11, and was there considered to be a genuine case of loss of memory. When admitted to "D" Block he was unable to give any account of his movements in London. He subsequently turned out to be a case of schizophrenia.

Diagnosis.

Amnesia may be associated with any of the following disorders, hysteria, epilepsy, manic-depressive psychosis, schizophrenia, confusional insanity, alcoholism, dementia paralytica, cerebral arteriosclerosis, senile dementia, trauma, intracranial tumour, chronic carbon monoxide poisoning, cerebral cysticercosis and amentia.

Schizophrenics often go away on little jaunts for which they have a subsequent amnesia.

The loss of memory for events which happen during and after an epileptic convulsion is well known. The epileptic may, however, without suffering from a convulsion, pass into a dream state during which he may wander or commit acts for which he later has a complete amnesia.

The majority of amnesias met with in soldiers are hysterical. The amnesia in hysteria is always for some experience with which a feeling of guilt, shame, or other strong emotion is associated. The onset frequently occurs when some disagreeable change is feared in a situation which has for long been a source of worry and anxiety to the patient. It is essential for his peace of mind that he should forget. He does so not merely by blotting out all memory of the painful situation, but also by repressing all associated memories of his life at that period which might conceivably remind him of his predicament. It is not a phenomenon to which we are all liable. The patient must be of the hysterical type. It may, in fact, be regarded as a rather feeble attempt of a weak personality to deal with an unpleasant situation. The hysterical individual is the possessor of a conflict normally solved in infancy. One never finds an adult neurosis without an infantile neurosis. The superficial conflicts of adult life have precipitated the amnesia, but these are connected by unconscious association with more distant infantile conflicts never satisfactorily solved.

Simulation must be eliminated. In this connexion the genuine case of hysterical amnesia makes some effort to recollect the past. The mood is usually one of mild depression and the patient is somewhat anxious and apprehensive. If cheerful and unperturbed simulation should be suspected. An attack of loss of memory is perhaps more frequently alleged than any other form of mental abnormality. It is a frequent excuse and a simple matter for a soldier charged with some military offence to assert that he has no memory at all concerning it. I have recently come across several such cases, and prolonged and careful observation was required before the truth could be ascertained.

Treatment.

Many cases recover spontaneously or following a talk with a relative. When persuasive questioning does not help to recover the forgotten material the various psychotherapeutic methods of free association, dream

analysis, automatic writing and hypnosis must be used. Suggestion by pressure on the eyeballs is occasionally helpful. Hypnosis is probably of all methods the most useful, and may be the only method by which the forgotten material may be recalled. With hypnosis care is required. Before an educated individual develops a complete and total amnesia the future must have been to him indeed a hopeless one. If his defences are broken down and he is now suddenly faced again with the intolerable situation much distress may be caused.

The treatment should not cease, however, with the mere disappearance of the amnesia. This is only a symptom which has relieved the patient from anxiety and served as a solution, however unsatisfactorily, for a difficult problem. The superficial conflict is merely the exciting precipitating factor. More distant conflicts still remain to be solved.

I have to thank Colonel Gordon Wilson, O.B.E., M.C., Officer Commanding Royal Victoria Hospital, Netley, for permission to send this article for publication.

MEMORANDUM CONCERNING THE USE OF SULPHONAMIDE DERIVATIVES FOR PROPHYLAXIS AND TREATMENT OF WOUND INFECTIONS.

(On October 11 we received this memorandum from the Directorate of Pathology, A.M.D.7, War Office.)

(PROVISIONAL.)

Preamble.—Experimental and clinical results having proved the effectiveness of sulphonamide derivatives in the treatment of streptococcal infections and having indicated that these compounds have also an action on anaerobic gas forming bacilli it is recommended that these compounds be given a trial in the field. In principle the earlier the drug is administered the more effective is the result, but some benefit may be anticipated even in well-established infections.

For the time being it is recommended that all wounds which from the clinical aspect appear likely to become the site of secondary coccal or gas gangrene infection should receive a prophylactic course of sulphonamide treatment at the *earliest possible opportunity* and that this prophylactic course should be extended if definite infection supervenes.

Designation of Sulphonamide Compounds in common use.

(1) Sulphanilamide (Synonyms: Sulphonamide P., Colsulanyde Streptocide, Prontosil album).

(2) M & B 693 (Synonyms: Sulphapyridene, Dagenan).

(3) M & B 693 Soluble (Synonym: Dagenan Sodium).

Administration.

(*a*) *General Principles :—*

(1) A prophylactic course should occupy about forty-eight hours.

(2) Courses of treatment for established or developing infections should extend over ten days, but if not effective by this time an interval of forty-eight hours should be allowed before continuing treatment.

(3) When an infection appears to be controlled, as judged by the temperature, small doses should be continued for a further three to five days in order to prevent relapses.

(4) The principle of effective treatment is to obtain a high blood concentration of the drug as rapidly as possible and to maintain this concentration at an effective level over a period of time. Because the drugs are rapidly excreted it is necessary, in order to maintain an effective level, to administer four hourly *night and day*.

(*b*) *Precautions* :—

Certain individuals are unduly sensitive to the drugs and there is no evidence yet available for assessment as to whether persons suffering from shock may not be even more sensitive. The reactions that may occur can be classified as (1) *Mild*, (2) *Serious*. The following is a list of such reactions together with comments as to how they are best avoided or treated.

(1) *Mild* :—

Nature of Reaction	Remarks.
Cyanosis :	Incidence reduced by prohibiting sulphur containing foods and especially by the avoidance of saline purges and drastic purges. Liquid paraffin is the best laxative. Cyanosis may be temporarily dispersed by giving 0·5 to 1·0 g. per day of methylene blue by the mouth. Cyanosis *per se* should not prohibit continuance of treatment.
Acidosis :	Treat by oral administration of sodium bicarbonate.
Drug fever :	Requires to be distinguished from fever due to recrudescence of infection. If true drug fever, omit drug.
Dermatitis :	Omit drug and induce diuresis with water or simple diuretic. May be the the prelude of more serious complications. Check leucocyte count if possible.
Dizziness, headache :	If intolerable, administer fluids freely. Check leucocyte count if severe.
Leucopenia :	Negligible unless rapidly progressive to below 3,000 leucocytes per cmm.
Hæmaturia (M&B 693 only) :	Administer fluids freely.
Jaundice, Neuritis	Omit drug. Induce diuresis. (*See* also Hæmolytic Anæmia.)

(2) *Serious* :—

Nature of Reaction	
Agranulocytosis :	Occurs after ten days or more of treatment. Incidence rare. Leucocyte count is the only method of diagnosis. Other symptoms: headache, deterioration of condition, fever, sore throat. Treat by transfusion and pentnucleotide.
Hæmolytic Anæmia :	Occurs early (two to four days). Incidence rare. Mortality low. Early signs jaundice and hæmoglobinuria. Omit drug, induce diuresis, transfuse if necessary.

(*c*) *Dosage* :—

(1) *Sulphanilamide.*—Tablets should be powdered and administered suspended in milk or water.

Prophylaxis.—4 g. (8 tablets) statim followed by 2 g. (4 tablets) in four hours' time followed by 1 g. (2 tablets) four hourly night and day for a period of forty-eight hours. If infection develops continue as for "treatment."

Treatment.—4 g. (8 tablets) statim followed by 2 g. (4 tablets) in four hours followed by 1 g. four hourly night and day for a maximum period of ten days. If infection is still uncontrolled allow an interval of forty-eight hours and then repeat the same course from the beginning or, if available, change on to M & B 693. If infection appears to be controlled during the first or later courses reduce dose to 0·5 g. (1 tablet) four hourly and continue for three to five days after the temperature has become normal.

Note.—During the first course of treatment if no clinical effect is evident within three days it is recommended that a change be made to M & B 693. But if some clinical effect is obvious it is worth while pursuing the full course of sulphanilamide.

(2) *M & B* 693.—Tablets should be powdered and administered in milk or water. If vomiting is troublesome split the doses and give at shorter intervals, e.g. instead of administering 1 g. four hourly give 0·5 g. two hourly.

Prophylaxis.—3 g. (6 tablets) statim, followed by 2 g. (4 tablets) in four hours' time followed by 1 g. (2 tablets) four hourly night and day for a period of forty-eight hours. If infection develops continue as for treatment.

Treatment.—The same procedure as for sulphanilamide except that the initial dose is 3 g. (6 tablets) instead of 4 g.

(3) *M & B* 693 *Soluble.*—This substance is of great value when swallowing is impossible or when gastric upset prevents absorption of the oral compound. It consists of a 33 per cent. solution (1 g. in 3 c.c.). Injections are best made intramuscularly, but as the solution is alkaline some reaction at the site of the needle puncture is common unless care is taken to inject deeply and avoid escape into the subcutaneous tissues. The solution may also be injected intravenously if the dose is diluted with 20 c.c. of sterile distilled water or normal saline. The drug may also be added in suitable quantity to intravenous drip transfusions of saline or blood (at the rate of 1 g. per four hours).

Dosage, Prophylaxis and Treatment.—1 g (1 ampoule) four hourly night and day, the prophylactic course being completed in forty-eight hours. The treatment course may be continued for ten days, but it is strongly recommended that a change over to the oral compound be effected at the earliest opportunity. The soluble compound is best used in the initial phases of a course of treatment and should not be regarded as a substitute for the oral compound ; it should only be used for a continuous course when oral therapy is impracticable.

SUPPLEMENTARY MEMORANDUM No. 1 CONCERNING THE USE OF SULPHONAMIDE DERIVATIVES FOR PROPHYLAXIS AND TREATMENT OF WOUND INFECTIONS.

In the memorandum A.M.D.7 dated 11th October, 1939, issued on this subject, it was emphasized that there is no evidence yet available for assessing the reaction to these drugs of persons suffering from shock. The fact that they may stand the drugs badly is probable. It is, therefore, advisable that the first batch of cases to which sulphonamide derivatives are administered for the purpose of prophylaxis or treatment should be carefully observed. If patients are severely shocked, treatment with these drugs would be better suspended until the circulation, temperature and urinary excretion have been re-established to reasonable levels by treatment of the shock per se. Should there be evidence which indicates that the drugs, in the doses suggested, are not well tolerated, adminstration should be suspended or the dose reduced.

If experience shows that the dosage given in the original memorandum is too high, it is suggested that the undermentioned modified course for prophylaxis and treatment should be tried on a further batch of cases.

Modified Course for Prophylaxis and Treatment.

Sulphanilamide and M & B 693.

Prophylaxis.—Total of 3 g. per diem to extend over a period of 4 days, administered as follows :—

1 tablet every 4 hours for 4 days.

Treatment.—First twenty-four hours : Total dosage 4 to 6 g. according to severity, but, in extreme cases, such as septicæmias, up to 9 g.

Spacing of dosage, four hourly, so that half the total dose is given during the first two administrations, and the balance equally divided between the remaining four administrations.

Second twenty-four hours: Total dosage and spacing similar to the first day.

Subsequent days: Dosage to be guided by the condition of the patient, *reducing* the administration of the drug to 2 to 3 g. per diem. Total period of administration not to exceed nine days.

Important Instruction.—It is extremely important that when patients, who have received prophylactic or curative treatment with these drugs, are transferred from one medical unit to another, clear indication should be given in the transfer documents as to treatment, and, in particular, which drug has been employed, as well as the total dosage given. If this is neglected, there may be a grave danger of overdosage with the consequent risk of agranulocytosis. Individuals who have been found to be unduly susceptible to sulphonamide derivatives should have this fact clearly stated on their documents, in order that the drugs may not again be administered at some future date. Susceptible persons inevitably suffer a recurrence of complications when a fresh course of the drug is instituted.

A.M.D.7.,
War Office. 1*st November*, 1939.

Editorials.

TREATMENT OF WAR WOUNDS AND FRACTURES.

THE closed method of treating fractures and the encasement of wounded limbs in plaster of Paris is advocated by Dr. Trueta, who had a unique experience in Barcelona during the Spanish war. The method was adopted with success at the base hospital. The principles of the treatment are the result of studies by William Baer and Winnett Orr, two surgeons in the United States, and in 1917 were accepted by Ogilvie in Great Britain. Winnett Orr was the first to bring to the notice of surgeons that rest was as important for the treating of the wounds of soft tissues as for the healing of broken bones.

Professor Hey Groves writes that the closed method must be seen to be believed. It produces ready healing of the wound and union of the bone. It leaves the patient in comfort except for the smell. For war wounds it affords a simple method which facilitates transport.

A standard method which can be adapted to a great variety of injuries is desirable: it must deal with results of both trauma and infection: the instruments and apparatus used should be few and the injured part should be immobilized so that the patient can be rapidly transported from the danger zone.

Trueta's system fulfils most of these requirements. His first step consists in *débridement* of the wound. The edges of the wound are excised and all contused tissue and non-viable muscular and cellular tissues are removed. Neighbouring cellular spaces are opened up. Foreign bodies and portions of bone devoid of periosteum are removed; fractures, if present, are reduced; the wound firmly dressed with sterile gauze and immediately immobilized with plaster, including the two adjacent joints if possible. Trueta states that it is only in exceptional cases that a gunshot wound can be sutured, and in these cases the stitches should be few and interrupted to allow of drainage. Tetanus antitoxin should be given in every case. After the treatment there is a rise of temperature, but even if the fever lasts two or three days he considers there is no cause for alarm, as in four or five days the patient is afebrile and in good condition. If possible premature removal of the plaster should be avoided. If all is not well there may be œdema of the extremities and all the usual signs of grave infection. The great danger is the development of gas gangrene.

The inconvenience of the plaster cast is the bad smell given off for a few days after its application; it is difficult to tolerate the first cast for more than ten or fifteen days or to keep the patient near others in the ward. The second cast can be kept on for twenty or thirty days. The

application of yeast has been recommended by Strasbourg surgeons to combat the smell. Trueta admits that a very bad smell accompanied by grave symptoms of infection is an indication for the renewal of the cast and further treatment of the underlying wound. The experience of Catalonia in the Spanish war showed that treatment by closed plaster was particularly adapted to the conditions of modern war, in which in addition to the usual military casualties there were a large number of civilians wounded by aerial bombardment. There are two types of case which should not be treated with plaster: (1) if there is cellulitis; and (2) if there is an already established anaerobic infection.

Wounds produced by aerial bombs are almost invariably very severe and Trueta considers this involves an immediate departure from the orthodox division of the treatment of such casualties into "first aid" and surgical treatment proper. This administrative separation was found out of place when planning the treatment of civilian air-raid casualties in Spain.

In the early stages of the war the organization of first-aid posts delayed the arrival of casualties at hospital, and the amputation-rate and death-rate were then high. After a time first-aid posts were abolished and both rates fell. Trueta believes that most surgeons who have had experience in treating air-raid casualties will agree that the three factors essential to reducing the toll of an aerial bombardment are rapid direct transport to the centre where immediate surgical treatment is possible, the application of plaster casts, and early evacuation of treated cases to a base hospital.

REPORT ON OCCUPANCY TESTS OF AIR RAID SHELTERS FOR FACTORY WORKERS.

The tests described in this report were carried out by J. and E. Hall, Ltd., at Dartford, Kent, under the direction of V. A. Patterson in collaboration with members of the medical profession and the Department of Industrial Physiology, London School of Hygiene and Tropical Medicine.

The shelters provided are of sufficient capacity to accommodate the whole staff of approximately 1,700 people.

Two types of shelter have been adopted, one of steel, completely below ground level, and the other of pre-cast concrete, only partly below ground level.

Steel Shelter.

This is a standard 27 feet long shelter supplied by Guest, Keen and Baldwin, as shown in fig. 1. It is constructed of corrugated steel of section as shown in the figure, and has a concrete floor 5 inches thick. The steel is surrounded by 6 inches of concrete, and a special reinforcing mat is embedded in the centre of the thickness of the concrete, the topmost part of which is 1 foot 9 inches below ground level. It is entered, by means of a

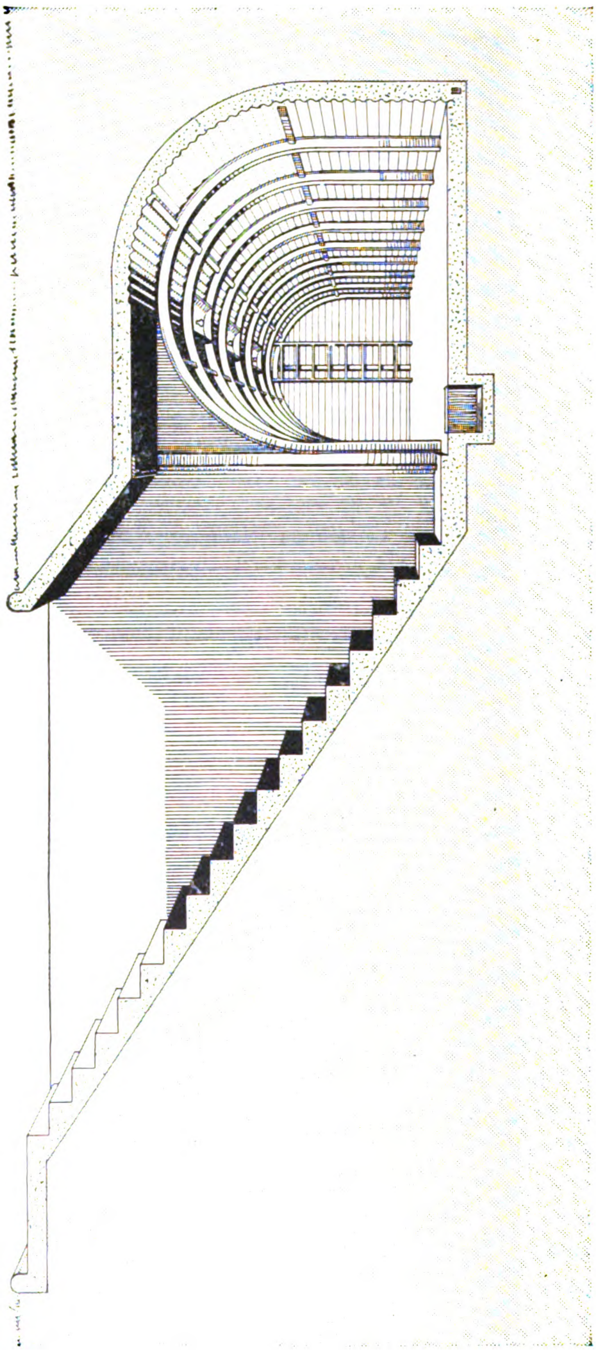


FIG. 1.—Steel shelter.

concrete stairway, through a gastight door at one end, and an alternative exit is provided at the other end by means of a gastight trap door reached by a step ladder.

Pre-Cast Concrete Shelter.

This is a standard 27 feet long Stent pre-cast concrete shelter, as shown in fig. 2. The floor is of concrete approximately 5 feet below general ground level.

There is no further protection beyond the pre-cast slabs above earth

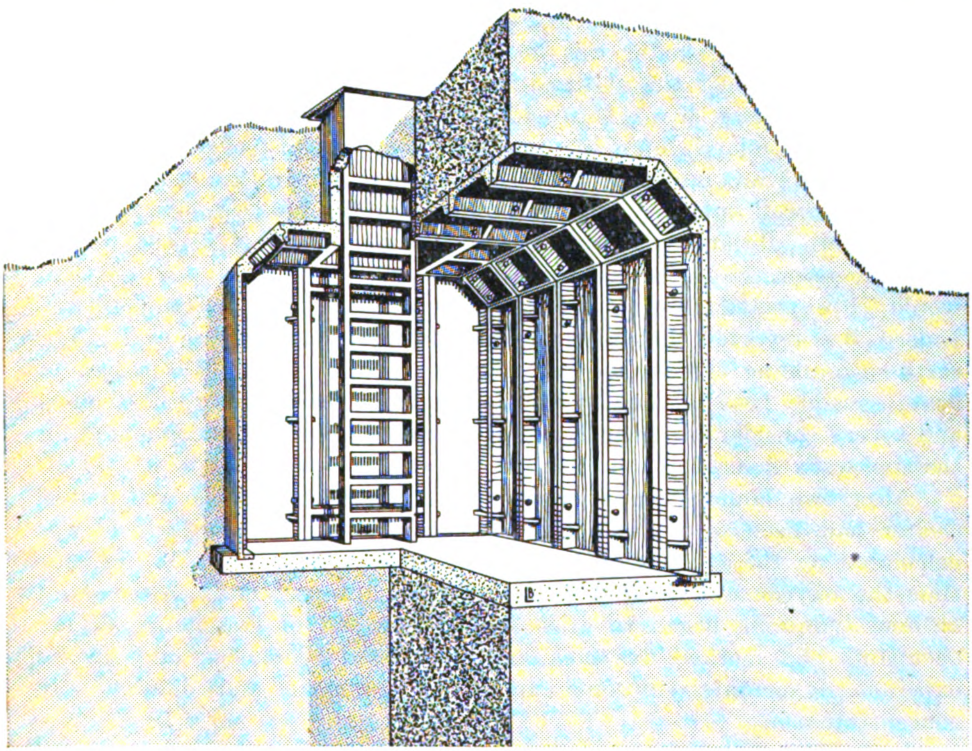


Fig. 2.—Concrete shelter.

level, except that afforded by the excavated earth which is used to cover the upper part of the shelter to a thickness of approximately 2 feet.

The objects of the tests were as follows :—

(i) To determine the length of time the full complement of occupants could remain inside without undue discomfort, with entrance and exit completely sealed.

(ii) To determine the rate of increase of temperature and moisture content under these conditions of occupancy.

(iii) To determine the rate of increase of concentration of CO_2 in the atmosphere under these conditions.

(In tests Nos. 5 and 6, the rate of decrease of oxygen concentration was also observed.)

(iv) To obtain any data of physical, physiological or psychological nature which would be of value should the shelters be used during air raids.

(v) To obtain information which might indicate in what ways the conditions inside the shelters might be controlled or improved during prolonged occupation.

When the shelters were sealed during occupation the air temperature near the roof rose considerably, and that near the floor to a less extent. Thus in one test, when the outside temperature was 68° F., the initial temperature in the shelter was 58° F., and after two hours' occupation the temperature near the roof had risen by 18° (to 76° F.) while that near the floor had risen by 7½° (to 65·5° F.). At the end of two hours' occupation the relative humidity near the floor was just over 90 per cent. Although there was a considerable rise in the air temperature, the temperature of the wall surfaces only rose by a few degrees, especially in the steel shelter. Because the wall remained cool, the effect of the rise in temperature on the thermal comfort of the occupants was much less than would be expected from a consideration only of the air temperature. Indeed, it is reported that thermal discomfort was not experienced. The earth surrounding the shelter has a great capacity for the absorption of heat; sensible heat is rapidly transferred from the walls of the shelter, and a very considerable quantity of the expired moisture is condensed on the cool walls instead of remaining in the atmosphere.

After two hours' occupation the CO_2 concentration in the sealed steel shelter had risen to 5·2 per cent, almost the exact value which was calculated on the assumption that the air leakage was zero. At the same time the oxygen was reduced to rather below 15 per cent. After about an hour symptoms began to arise, and at the end of two hours all the occupants had marked dyspnœa, and many had headache; and several experienced mental symptoms, impaired judgment and difficulty in concentration.

In a similar experiment oxygen was supplied after the first hour and soda-lime containers were exposed. These measures, together with fanning, freshened the atmosphere and appeared to restore conditions to what they were on entry, according to subjective impression.

The results of the experiments led to the following conclusions and recommendations :—

Air raid shelters for factory workers have been tested under conditions of occupancy and duration which might occur in practice. 234 different individuals have been subjected to the tests without any permanent ill-effects, and conditions influencing comfort in the shelters have been studied.

Underground shelters of standard steel construction, designed for fifty factory workers, can be fully occupied for a period of two hours without

ventilation, and with exits and entrances sealed against gas without any serious effects on the occupants, although some discomfort and mental impairment may be apparent towards the end of this period.

It will not be necessary to close gas-proof doors until a gas alarm is given, and the tests carried out with these doors ajar show that the natural ventilation thereby permitted is sufficient to maintain comfortable conditions inside shelters of the types tested.

A small air filtration plant would enable these shelters to be occupied for longer periods without discomfort.

In fully occupied underground steel shelters discomfort due to heat and moisture accumulation does not arise in a period of two hours, even though no ventilation is provided.

It appears that there is less likelihood of unpleasant concentrations of CO_2 developing in sealed concrete shelters than in steel shelters. This may possibly be due to the CO_2 permeability and/or absorbing capacity for CO_2 possessed by concrete.

If it is essential that individuals in a fully occupied shelter should retain their full mental alertness, e.g. in control room, then it is desirable that either: (*a*) artificial air filtration and ventilation should be maintained, or (*b*) adequate oxygen should be liberated at hourly intervals, and CO_2 continuously partially absorbed by chemicals such as soda-lime exposed in suitable containers and locations.

Clinical and other Notes.

EXERCISES IN THE FIELD.

By Lieutenant-Colonel E. R. LOVELL, T.D.,
Royal Army Medical Corps (T.A.).

The following exercise has been devised to give N.C.O.s practice in map reading, and with the special object of training them to find quickly landmarks which in open warfare might be selected as places where small dumps of wounded would be left for collection.

The companies are sent out separately over a circular or figure-of-eight course in opposite directions. After parting at camp, this prevents them from getting in one another's way and indicating to others the near presence of a clue. At the distal point of the march they meet and a mid-day halt is arranged.

At three-quarters of a mile to a mile intervals, according to the type of country, definite spots are selected and the map references worked out. On leaving camp the senior N.C.O. in charge of the company is given the map reference of the first landmark, its description, and also a note of the hiding place there, where the clue for the second landmark will be found.

This procedure is repeated until the companies reach the midday rendezvous.

In order to prevent one N.C.O. from doing all the map reading, attached to certain clues are added notes to say that the N.C.O. in charge has become a casualty. He then has to pass on the command to his next junior.

When the N.C.O. finds his clue, he works out the position on the map. He is then expected to march the company to within at least one hundred yards of his object, halt them and locate the exact spot by a local search.

Officers in cars can get from place to place if necessary and assist lost companies, observe whether clues are found in a systematic manner or by a general and haphazard search and see that N.C.O.s, who have become casualties are not assisting.

After the mid-day halt, the companies return home. "A" company will now get the clues that "B" company has already found and vice versa.

This introduces at once a competitive interest. On the return of the companies, they move off under the charge of the junior N.C.O., the senior N.C.O.s returning in sequence of seniority at the clues where reinforcements are noted.

A short series of specimen clues may make the working of this plan clearer.

This exercise was first used by the writer while serving with the 170th Cavalry Field Ambulance, in 1932, and has been used at every Annual Training since in that unit or the 164th Field Ambulance.

It was at once dubbed " The Treasure Hunt " by the men and has not only proved a very popular item of training, but has improved immensely the map reading powers of the unit.

During halts, officers have given exercises in general map reading and in the use of the compass.

At last year's Annual Training, it was found necessary, in order to complete the circular course, to march across open country for several miles in an area where there were not only no easily identifiable points but where sundry tracks had been added after the printing of the map. Despite this, both companies suffered very little delay.

In 1932 men were actually posted at the various map references to represent patients. They were collected and marched on with the company. This method was given up as it entailed delay in transporting men and posting them, whereas by means of envelopes containing clues, one officer in a car can run quickly around the course and post his clues unaided.

A CASE OF SUDDEN UNEXPECTED DEATH DUE TO BILATERAL PNEUMOTHORAX.

By Major F. J. O'Meara,
Royal Army Medical Corps.

The following clinical notes are submitted for publication to supplement the report of a similar case by Priest (1937). Serjeant S. was admitted to the Military Hospital, Catterick Camp, on March 28, 1939. He had consulted a doctor in Darlington before his admission to hospital as he suffered from attacks of severe pain in the upper abdomen at irregular intervals. A diagnosis of peptic ulcer had been made.

Previous History.—His medical history sheet has nine entries for admission to hospital with benign tertian malaria between 1927 and 1930. A medical board at Karachi in December 1929 had sent him to England as an invalid. His appendix had been removed in 1936 at Hong Kong. He was admitted to the Cambridge Hospital, Aldershot, in 1938, diagnosed acute gastritis.

Present Illness.—He suffers from occasional attacks of severe sharp pain in the upper abdomen, which have been present for three or four years. He fainted in barracks this morning during such an attack. He was admitted to hospital.

On admission temperature 97° F., pulse 86. A heavy florid man aged 34, who looks in rude health. Head and neck: Nothing abnormal detected.

Thorax : Barrel shaped. Resonant note on percussion all over both lungs. Poor air entry all over both lungs. Heart appears normal.

Abdomen : No muscular resistance or rigidity. No maximum point of tenderness.

Treatment : Bed. Milk feeds, 6 ounces two hourly.

29th : Temperature 97° F., pulse 88. Unchanged. Urine : Reaction acid. Specific gravity 1020. No albumin. No sugar. Deposit : Phosphates.

30th : Temperature 97° F., pulse 78. No complaint.

31st : Cholecystography : Gall-bladder visualized at fifteen and seventeen hours after "Opacol." Empty after the fatty meal. Poor concentration.

April 1 : Temperature 97° F., pulse 62. Complained at 1 a.m. of abdominal pain. Relieved by hot water bottle. Examination next morning showed a flaccid abdomen, there was no pain.

2nd : Unchanged.

3rd : Temperature 97° F., pulse 68. Stool negative for occult blood. Fractional test meal : Resting juice 23 cubic centimetres. Stomach empty at two and a half hours. Free HCl. within normal limits.

4th : Slept well until 5 a.m. Awakened. Complained of severe pain in the upper abdomen. Died 5.15 a.m.

11.30 a.m. : Post-mortem examination : Body of a medium sized heavy man. Well marked post-mortem staining, rigor mortis not established.

Thorax : Pericardium normal, ½ ounce of free fluid in it.

Heart : Within normal limits.

Lungs : Both lungs collapsed. Firm, not containing air. No adhesions or scarring.

Mediastinum : Bubbles of air throughout the tissues (surgical emphysema).

Abdomen : No free peritoneal fluid. All the organs were healthy.

The lungs were re-examined about two hours after removal from the body. They had then expanded and become crepitant, with bullæ along the anterior edges, as occurs in emphysema. Section did not reveal any evidence of tubercular disease. In due course microscopical examination of tissue from both lungs gave the appearance of a generalized vesicular emphysema. The changes were most marked in the left lung, in the upper lobe of which little of the alveolar walls remained. Atrophy of the alveolar walls was also present in the right lung. A number of the small arteries were obliterated and those which remained patent were congested. No further evidence of disease of the lungs was detected.

My thanks are due to Colonel H. C. Gall, late R.A.M.C., for permission to forward this record for publication and to Major W. H. Carter, R.A.M.C., for the report on the miscroscopic appearance of the lung tissue removed at the post-mortem examination.

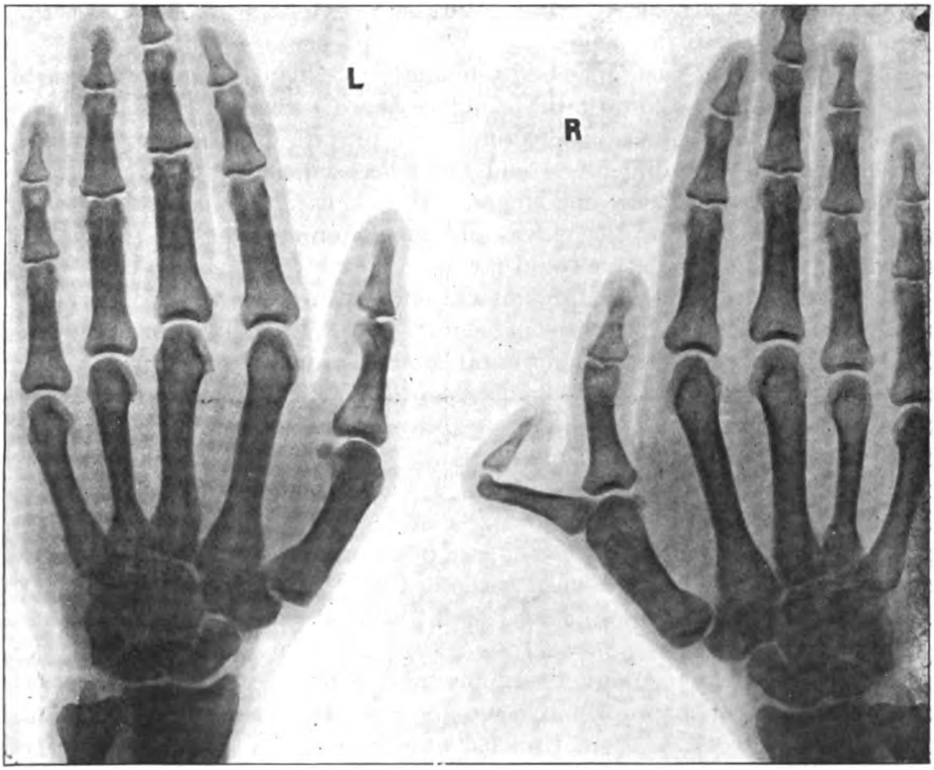
REFERENCE.

PRIEST, R. "Bilateral Spontaneous Pneumothorax," *Brit. Med. Journ.*, August 14, 1937, 2, 321.

MALI'S DISEASE.

By Lieutenant-Colonel H. G. WINTER,
Royal Army Medical Corps.

On page 269 of No. 4, Vol. lxxii, April, 1939, of this Journal, under the heading "Polydactylism, Syndactylism, or Both ?" Lieutenant-Colonel K. P. Mackenzie, R.A.M.C., published an X-ray photograph of the hands of an Indian gardener.



The accompanying print, again of the hands of an Indian gardener of small stature, may also be of some clinical interest.

A CASE OF PSEUDOCYESIS.

By Captain J. L. MARTIN,
Royal Army Medical Corps.

The following are notes of a case one reads about in textbooks, but seldom meets. Besides its rarity it has its debatable points.

Mrs. X. Y. Z., aged 36, nullipara, normal regular menses since puberty, well developed in body and limb, and of normal mentality, reported at the ante-natal clinic in November, 1938, that she was pregnant. She

complained of amenorrhœa since June 26, 1938, morning sickness which had lately ceased, increasing distension of the abdomen, frequency of micturition, enlarging mammary glands, and also that fœtal movements were being felt. She was married, not on the strength, in October, 1938. She was duly recorded as pregnant, and accommodation booked about April 3, 1939, for her confinement.

On February 1, 1939, on palpation, a tumour of thirty to thirty-two weeks was felt in the abdomen with not quite the typical normal sensation, resembling a tense resilient " bag of water " extending from above the umbilicus down into the pelvis.

When standing she appeared obviously pregnant. No fœtal parts were palpable and no fœtal heart could be heard. She was definite about fœtal movements. A vaginal examination proved unsatisfactory as the patient besides being difficult, would not relax sufficiently to allow proper vaginal examination with one finger. It was, however, ascertained that there was no blueing of the vulva, and no softening of either the vagina or cervix, though this latter could not be properly palpated.

On March 15, 1939, the tumour was only up to the level of a twenty-six to twenty-eight weeks' uterus in height. She still felt fœtal movements. No fœtal parts were felt, and no fœtal heart was heard. Percussion over the tumour was resonant. The breasts showed no engorgement, and no signs of lactation were noticed. Blood-pressure and urine were normal. The case appeared very suspicious, and an X-ray was suggested, which, however, could not be carried out until March 1, 1939, when no fœtus was seen. The X-ray was interesting in showing a circular shadow over the 2nd, 3rd, and 4th lumbar vertebræ about the size of a grapefruit, which at first sight might appear to be a fœtal head without a body, presenting at that level. This proved to be the stomach, well outlined with air—an unusual phenomenon.

Until the X-ray the patient strongly maintained that she was pregnant, and was definite about fœtal movements. She was surprised there was any doubt, and it came as a great shock to both her and her husband that this was not the case. For months past she had knitted clothes in preparation for the baby and bought the pram. The day after she was informed she was not pregnant she wore her corsets again, a thing she had been unable to do " since last October," and her abdominal wall rapidly retracted to within its normal limits.

On April 1, 1939, she had her first menses since June, 1938, which lasted six days, the first two days being very heavy and the last four were normal. Her health was good and she had got over her disappointment. Following this period she was admitted to hospital to have all her teeth extracted under general anæsthesia and the opportunity was taken to examine her pelvically. The uterus and cervix were normal in size, shape, position, and consistency, and there were no abnormalities in the adnexa. Abdominal palpation revealed a lax abdomen without abnormality.

It is easy to be wise after the event. Perhaps the condition should have been diagnosed very much earlier on.

Up to the end of the year she had been seen by three medical officers, and the straightforward history of a healthy married woman which she gave was almost conclusive of pregnancy. Later when suspicion had arisen, the X-rays taken, and the late marriage, "off the strength," came to light, the case was obvious.

A Zondek-Aschheim test earlier on would have saved a lot of trouble and expense.

My thanks are due to Lieutenant-Colonel R. W. Galloway, D.S.O., R.A.M.C., Officer Commanding Military Hospital, Bovington Camp, for permission to submit this article for publication, and to Major D. W. M. Mackenzie, R.A.M.C., for reporting on the X-rays.

Echoes of the Past.

TWENTY YEARS AFTER.[1]

By H. SKIPTON STACY, M.D., Ch.M.(Syd.), F.R.A.C.S.

Honorary Consulting Surgeon at Sydney Hospital, Ryde Hospital, and Royal South Sydney Hospital.

UNTIL man has evolved a more intelligent means of settling his disputes than he has shown thus far in history, it must be the duty of the A.M.C. to keep in the forefront of medical and surgical knowledge, that the results of war may be mitigated as much as possible.

An officer of the A.A.M.C. has remarked to me that the conditions under which C.C.S. worked in the Great War will be looked upon as barbaric by those attached to one in the next war. My hope and trust is that this will be so. One of the most important features of the equipment will be portable X-rays. He visualizes (*a*) Numerous specialists; also (*b*) sera and various proprietary remedies of a curative nature.

As regards (*a*) I am afraid I am not optimistic, unless there is some other plan than voluntary enlistment. As regards (*b*) here again there are limits. "I once was young but now am old," and have observed that the enthusiasm for some of these remedies in private practice is not reflected in the more coldly scientific atmosphere of a teaching hospital.

These notes made in 1916–17 lay untouched in a drawer for twenty years; most members of the profession (like their lay friends) wished to

[1] Reprinted from *The General Practitioner of Australia and New Zealand*, July, August, September and October, 1938.

forget war. But for some years now I have been impressed with the need the medical profession have (particularly those on the staffs of big hospitals) to co-ordinate a little more their clinical knowledge with post-mortem findings. I turned to these notes and found, when I came to analyse them closely, lessons of great value.

From Tennyson's *Ulysses* I have received the inspiration—

> "To strive, to seek, to find, and not to yield."

In the same poem there is an earlier couplet—

> "How dull it is to pause, to make an end,
> To rust unburnish'd, not to shine in use!"

The work was done in Flanders in 1916–17, when I was O.C. No. 2 A.C.C.S. We were pitched in a field alongside the Calais-Lille railway line, about a mile from Steenwerk, and several miles behind the front line at Ploogsteert.

These sixty-three autopsies were performed by an orderly under my close supervision, at a time when things were "quiet on the Western Front." The notes I made on these autopsies, with associated comments, together with the clinical histories, are exactly as I made them in Flanders.

Within the last few weeks (July, 1937) I have grouped, tabulated, and reviewed them in the light of knowledge acquired since then.

I think it may be said that these cases represent fairly accurately the causes of death in a Casualty Clearing Station; nearer the Front there are more deaths from hæmorrhage and shock; also from the more severe wounds of the head and abdomen, and gaping wounds of the chest.

I think that close co-ordination of clinical and post-mortem observation was very unusual at the Front, and for that reason, is I think worth recording in detail.

The survival time in the tables is approximately the time of survival after admission to the clearing station.

Some of the organs which are discussed in these pages have found their way to the Pathological Museums of Australian Medical Schools. Others were in the P.M. Hut at the time of its destruction (with loss of life amongst the wounded in the adjoining tent) when the clearing station was bombed by German aeroplanes in 1917. We sent all the specimens we could to Sir Arthur Keith, in London.

Even early in 1917 that subdivision into specialties, which has been such a conspicuous feature of surgery in recent years, was beginning to be evident.

I.—Gunshot Wounds of the Head and Neck.

Head cases were beginning to be concentrated in a C.C.S. in Hazebrouck, further back.

Later, in 1917, a special Abdominal Operating Station was instituted nearer the front line.

CASE 2.—Meningococcal Septicæmia.

(This is the sole exception to Death by Gunshot Wound.)

Clinical History.—Nature of illness : Meningococcal Septicæmia.

Signs and symptoms : Admitted to a field ambulance yesterday suffering from pains in the upper abdomen. His condition was quite good and the pain was relieved by a hot-water bottle. He was quite well at midnight. This morning he has a diffuse purpuric rash and complains of pain in all his limbs, the skin of his legs being very tender. He also has dyspnœa.

Post-mortem Result.—Head : No abnormality observed. (Spinal cord not examined.)

Chest : Lungs normal. The larynx below the cords was much congested.

Abdomen : Nil.

Limbs : Nil.

Bacteriological Findings : In the blood smear there were no organisms ; there was a (?) polynuclear leucocytosis.

Comments : Captain Ellis (No. 5 Canadian Laboratory) says he has examined blood in four similar cases, and only found organisms in one out of the four. They were all meningococcal septicæmia.

CASE 4.—Fracture of Skull and Laceration of Brain.

Clinical History.—Nature of wound : Gunshot wound, head. (Rifle bullet.)

Operation : Lumbar puncture alone was done ; the fluid was straw-coloured due to blood pigment ; no growth in cultures.

Survival : For seventeen days. Evacuated to the Base on the ninth day.

Post-mortem Result (communicated).—Head : Basal meningitis ; much brain softening ; the bullet had passed through both occipital lobes and fractured the opposite parietal bone.

CASE 9.—Laceration of Brain.

Clinical History.—Nature of wound : Gunshot wound, head. (Shrapnel.)

Signs and symptoms : Unconscious ; right leg drawn up ; frequent twitchings of the right side of the lip, which is apparently paralysed. Both arms are convulsed now and again ; most marked in the fingers of the left hand. Pulse is good. The same evening the pulse is 120, temperature 101° F. Left arm and leg flaccid ; does not move them. Right arm and leg apparently normal. Reflexes: Left knee-jerks and left plantar are absent ; right are normal. There are two wounds at the root of the nose ; another punctured wound in the right temporal region. The day after operation he was more deeply unconscious. Temperature 104° F., pulse 140, respirations rapid but regular.

X-ray report : A piece of shrapnel shown to be in the mid-line according to the antero-posterior picture, and in the middle fossa according to the lateral. ? Fracture of base of skull in the vicinity.

Operation : Nose wounds found to be superficial only. The wound in the temporal region leads through the temporal bone, through the dura, down to lacerated brain ; some dark subdural clot. Decompression done and the wound closed.

Survival : Thirty hours.

Post-mortem Result.—Head : Punctured wound of right temporal bone, no radiation of fracture. Decompression opening about the size of half a crown ; no extradural hæmorrhage, but a large subdural one extending over the middle portion of the right cerebral hemisphere to the mid-line ; also free blood at the base of the skull. Over the left cerebral hemisphere there was some slight subarachnoid hæmorrhage. The right temporo-sphenoidal lobe at its apex was much lacerated ; a track led in from this medially to the side of the pons, where the piece of shrapnel was found lying. Ventricles normal.

Comments : Probably no hope from the start. Perhaps the operation might have been done a little more speedily, and the decompression a little larger. There was no hope of removing the shrapnel.

CASE 11.—Laceration of Brain and Septic Meningitis Hernia Cerebri.

Clinical History.—Nature of wound : Gunshot wound, head.

Signs and symptoms : Wounded in the right parietal region, some brain tissue exuding out. On admission was unconscious but gradually improved. Ecchymosis of the left upper eyelid. Eyes normal. Limbs : No rigidity ; unable to move left arm or leg. Face normal. Reflexes : Left knee-jerks sluggish, left plantar absent ; right knee-jerks and plantar normal. Temperature 99·6° F. and pulse 90 on admission ; after operation temperature 101° F., pulse 132. The next day after operation temperature and pulse were still elevated. Incontinence. Several days later he was much more conscious, but the left arm and leg were still paralysed ; left arm somewhat rigid, leg less so. Reflexes : Knee-jerks on both sides normal and equal ; left plantar response was extensor ; right plantar normal. Next day the salt pack was removed ; temperature 102° F., pulse 93. Next day temperature normal ; is improving. Several days later perfectly conscious and rational. Still paralysed in the left arm and leg ; no rigidity. Reflexes : Left plantar absent, right plantar normal ; knee-jerks normal. Three days later scalp flaps became gangrenous and were cut away. Portions of brain the size of a mandarin are now protruding, very slight pulsation, discharge somewhat offensive. Temperature normal, pulse 62. Is quite rational and normal ; feels well. Four days later the hernia had increased in size to that of an orange ; the herniated-brain is plum-coloured, with here and there dark blood clots. Next day became more drowsy. Temperature 104° F., pulse 110. Still paralysed, no rigidity. Reflexes as before. Hernia is sloughing away. All lines in the face are obliterated ; smooth and expressionless.

Three days later the hernia had quite sloughed away; surface of wound very foul. Temperature 103° F. Died.

Survival: Eighteen days.

Post-mortem Result.—Head: Linear fracture extends forward and laterally from the hole in the right parietal bone. Brain is very pale and soft. The dural adhesions are apparently sufficient to prevent any spread of the sepsis medially, but there is septic meningitis down in the floor of the middle fossa on the right side, directly continuous with the septic area.

CASE 15.—Laceration of Brain.

Clinical History.—Nature of wound: Gunshot wound, head.

Signs and symptoms: Paralysed on the left side; all limbs spastic, especially on the left side. Reflexes: Knee-jerks much exaggerated; double Babinski. Pulse weak and breathing very rapidly.

Survival: About ten hours.

Post-mortem Result.—Head: Wound of entry about one inch above the right eyebrow; exit wound in the left temporal region about two inches above the ear. Much effused blood in the left temporal muscle. Diffuse subdural hæmorrhage over the cerebral hemispheres, and on the base of the skull. A track leading through the right frontal lobe and through the left temporosphenoidal lobe; much more laceration at the outlet than at the inlet. Track when laid open was quite wide and contained much dark clot. Lateral ventricles contained blood clot, especially the left. There was also diffuse subarachnoid hæmorrhage over the hemispheres.

Comments: Naturally operation would have been useless. The wide track indicates that with care one need not do much more damage in following the track of a foreign body very carefully and trying to extract it.

CASE 17.—Asphyxia from Hæmorrhage.

Clinical History.—Nature of wound: Gunshot wound, face. (Shrapnel.)

Signs and symptoms: brought in dead.

Post-mortem Result.—Head: A wound through the left angle of the lip fracturing the alveolar process of the upper and lower jaw; hole through the epiglottis; in the upper part of the pharynx—immediately behind the glottis—was a very large piece of shrapnel. The larynx, trachea, bronchi, bronchioles, etc., contained much blood.

Death was due to asphyxia from blood entering the larynx in the collapse that followed the wounding.

CASE 18.—Laceration of Brain.

Clinical History.—Nature of wound: Gunshot wound, head, and multiple wounds of the body.

Signs and symptoms: On admission very pale and collapsed. Remained in this condition throughout; was semi-conscious. Temperature 97° F.,

pulse 100. Later the temperature went to 100°, 102°, 100°, and 98° F., at which he died. Pulse went to 120, 160, and 130 at the time of death. The wound of entrance was one inch behind and below the left mastoid process.

Survival: About sixty hours.

Post-mortem Result.—Head: The neck wound leads over to the right posterior fossa just behind the right lateral sinus; here the bone is comminuted and depressed into the cranial cavity, though the dura is not lacerated. There is subarachnoid hæmorrhage over the posterior part of both cerebral hemispheres; the posterior portion of the right is depressed below the level of the anterior portion. The right cerebellar lobe is lacerated.

Chest: Lungs congested, otherwise normal.

CASE 20.—Laceration of Brain (?) Septic Meningitis.

Clinical History.—Nature of wound: Gunshot wound, head.

Signs and symptoms: A furrowed wound of the scalp with lacerated brain matter protruding. Is unconscious, but becoming less so. The wound is a little to the left of the mid-line over the parietal region. He can move his left arm. The right arm and right leg are paralysed, not rigid. Reflexes: Right knee-jerks only just elicited; left knee-jerks active: both plantar are absent. Eyes are normal. Next day temperature was down to 101° F., and pulse 110, but there was no difference in his general condition. Next day temperature 103° F., pulse 130. Since the operation his respirations have been between 34 and 40.

Operation: The wound was excised and flaps reflected; there was a hole in the skull antero-posteriorly just to the left of the mid-line. It runs into a linear fracture anteriorly, also posteriorly into a linear fracture which runs backwards and downwards into the occipital region. The hole was enlarged all round; out of this lacerated brain tissue was exuding and a few small pieces of bone were observed. Bone was removed along both sides of the posterior linear fracture; along this track was extradural hæmorrhage. After this liberal decompression, pulsation returned well. A flap of temporal fascia was put over two-thirds of the exposed brain. The scalp flaps were undermined and brought together, drains being left at two angles of the wound. He stood the operation very well.

X-ray Report: Antero-posteriorly foreign bodies (? bone) are seen near the centre of the brain. Laterally, several pieces of bone (or ? shrapnel) just below the level of the cranial vault; there is a space where the bone has been blown away; radiating downwards, forwards, and backwards from this are fissured fractures.

Survival: Fifty hours.

Post-mortem Result.—Head: Fissured fractures of the skull extended forward to the right eyebrow and backwards to the inion. Blood clot all along the line of fracture, but not much to one side of it except down over the left temporal region, and not excessive there. The whole brain was hyperæmic; small vessels even distended, as well as the large ones in the

sulci. Much pulping of the left cerebral hemisphere under the site of the wound; it extended to the median longitudinal fissure. Under the dura about half an inch away from the torn edge was a piece of bone; there was also another fragment of bone deeper down amidst the pulp. The dura matter was adherent to the arachnoid outside the injured area.

Comments: There was nothing macroscopic to account for the twitching of the sound side of the body. (? was the hyperæmia the cause of it, and was this due to infection.)

Probably where there are bony fragments or foreign bodies in the brain it would be better to leave the wound more open, for it is a common experience that where foreign bodies (and ? bone) have been driven into the brain and not recovered at operation, sepsis ensues, and death usually follows.

CASE 21.—Laceration of Brain.

Clinical History.—Nature of wound: Gunshot wound, head. (Shrapnel.)

Signs and symptoms: Struck on the back of the head with shrapnel. Is unconscious; Cheyne Stokes breathing; pupils both widely dilated and fixed; pulse feeble.

Survival: About seven hours.

Post-mortem Result.—Head: Wound near the middle line about three-quarters of an inch above the inion; out of this lacerated brain matter protruded. The occipital bone at this spot had an opening about the size of sixpence; from this a stellate fracture radiated, particularly along towards the left temporo-parietal region. There was a large subdural hæmorrhage over the left cerebral hemisphere; the left occipital lobe was extensively lacerated at its pole; about one and a half inches in was found a piece of bone about the size of the hole in the occipital bone; there was a small laceration at the posterior end of the left temporosphenoidal lobe. In the outer end of the Fissure of Sylvius was discovered the piece of shrapnel. No hæmorrhage in the lateral or other ventricles. Cerebellum quite normal.

CASE 24.—Hæmorrhage from Jugular Vein.

Clinical History.—Nature of wound: Gunshot wound, neck.

Signs and symptoms: Pale and collapsed. The wound in the neck, which was thought to involve the jugular vein, had been plugged with gauze, and was not bleeding on admission.

Survival: Seven and a half hours.

Post-mortem Result.—Head: Internal jugular vein severed; clot in it; lower down the neck it was completely empty. Carotid vessels normal. The wound did not extend into the buccal cavity, pharynx or larynx, which were quite free of blood.

Comment: Could find no other cause of death than hæmorrhage.

CASE 25.—Laceration of Brain.

Clinical History.—Nature of wound: Multiple wounds of limbs and face, involving eye.

Signs and symptoms: Semi-conscious; not paralysed. Right eye

destroyed. Temperature 102° F., and pulse 104. Became increasingly unconscious. Next day (the day after operation) temperature normal, pulse 102. Died, never regaining consciousness after the operation.

Operation: Multiple wounds excised and right eye removed.

Survival: Thirty hours.

Post-mortem Result.—Head: The wound over the right cheek had chipped a fragment off the malar bone; then the missile (a very small piece of shrapnel) embedded itself in the temporal bone. The shrapnel that had destroyed the right eye penetrated (by an opening only large enough to take a pin) the roof of the orbit, then the right frontal lobe, in which it caused an extensive laceration. Some blood in the lateral ventricle and an extensive blood clot all over the right cerebral hemisphere.

Comments: He was thought to have been a case of multiple flesh wounds (together with the eye) but a cerebral lesion was not suspected. The fact that he gradually became less conscious indicated a probable cerebral injury; but, in the stress of the heavy day's operating, this was overlooked. Not that he could have been saved. Neither the temperature nor the pulse were of much value as regards an indication of a cerebral lesion.

CASE 28.—Laceration of Brain and Fracture of Skull.

Clinical History.—Nature of wound: Head wound.

Signs and symptoms: Dug-out collapsed on him. Temperature 97° F., pulse 48. Breathing of the Cheyne Stokes variety. About nine hours later, just before death, temperature was 105·8° F. and pulse 158. Eyes: Right pupil contracted and fixed; left pupil slightly more dilated and fixed. Hæmorrhage under the left eyelid. Limbs: Both arms flaccid; both legs somewhat rigid. Reflexes: Knee-jerks exaggerated; plantar absent.

Survival: About ten hours.

Post-mortem Result.—Head: Much sub-aponeurotic contusion. Fracture of the right middle fossa, extending from the petrous bone through the sella turcica and sphenoidal sinus (through to the nasopharynx) across the left middle fossa into the temporal bone. Also a fracture of the left anterior fossa extending outwards and upwards, with a little extradural hæmorrhage in its vicinity, and some hæmorrhage into the orbit.

Brain: Some contusion about the junction of the right temporosphenoidal and occipital lobes. Laceration of the pons about its junction with crura. Right tympanic membrane ruptured; left intact. A little hæmorrhage into the lateral ventricle. Marked subarachnoid hæmorrhage over the surface of the cerebral hemisphere.

CASE 32.—Laceration of Brain.

Clinical History.—Nature of wound: Gunshot wound, head. (Shrapnel.)

Signs and symptoms: Unconscious; legs spastic, arms flaccid. Eyes: Pupils contracted. Wound is near the posterior inferior angle of the right parietal bone; blood and lacerated brain exuding. Pulse 59 on admission. 80 several hours later.

X-ray report : Antero-posterior radiograph shows shrapnel to be in the middle line ; it also showed a puncture of the cranium, but no linear fractures. Localizing radiographs showed the shrapnel at a depth of 8½ centimetres from a spot just in front of the ear.

Operation : Wounded before midnight. Operated on at 4 a.m. Under anæsthetic, wound in the bone enlarged ; brain lacerated ; along the probable track a probe was passed, then the electro-magnet, but without success.

Survival : About seven hours.

Post-mortem Result.—Head : Diffuse subarachnoid hæmorrhage over both cerebral hemispheres, showing blue beneath the dura. Blood clot both above and beneath the tentorium cerebelli ; a laceration of the occipital pole of the right cerebral hemisphere on its under surface ; in the cavity so formed (about one-and-a-half inches in) was a piece of bone ; the upper surface of the right lobe of the cerebellum was also somewhat lacerated. The piece of shrapnel fell out on the table, but where exactly it came from it was hard to say.

Comments : Spastic cases mostly seem to die. Bluish appearance under the dura is often due to subarachnoid hæmorrhage for which opening of the dura would probably do no good. Pieces of shrapnel, etc., often drive particles of bone into the brain.

Case 34.—Abscess of the Brain.

Clinical History.—Nature of wound : Gunshot wound, head.

Signs and symptoms : Has a punctured wound of the frontal bone just above eyebrow. Progressed well after operation. Pulse and temperature remained normal ; gradually regained consciousness, though he had incontinence of urine for three days ; from then on kept improving although he was a little restless at night. About the tenth day he sat up to read the paper ; the following day was not so well, had slight hernia cerebri. Evacuated to the Base ; heard he afterwards died of abscess in the frontal lobe.

X-ray report : X-ray shows small bone fragments apparently spread out in the frontal lobe fan-shaped ; no definite foreign body.

Operation : The wound was excised and the opening in the skull enlarged, allowing blood clot to escape ; no foreign body or bone fragments in the brain were removed ; wounds in the skull not covered by scalp but a dressing put down into it.

Comments : Died at the Base, so I have not any post-mortem details. In my opinion more bone should have been removed at the time of operation to allow better decompression and a more thorough removal of blood clot. Possibly the scalp should have been used to cover the defect in the skull, and so prevent any hernia cerebri. These head cases need keeping very quiet on their backs for some time to prevent any increase in the intracranial tension.

CASE 39.—Fracture of Spine. Transection of Spinal Cord.

Clinical History.—Nature of wound: Gunshot wound, neck. (Bullet.)

Signs and symptoms: Shot through the neck by sniper; fell to the ground at once; has been unable to move the legs at all and arms very slightly. Sensation dulled below the shoulders. Conscious, highly intelligent, and took a keen interest in his case. Motor functions: Complete paralysis of lower limbs, abdominal and thoracic muscles. Slight movement of flexors of both forearms but complete paralysis of muscles of arms and shoulder girdles. Muscles of neck and face unaffected. Reflexes: All superficial and tendon reflexes absent, loss of control over organic reflexes. Sensation: Complete absence of sensation up to the second thoracic interspace; good over the first two interspaces, neck and head. In the arms sensation was abolished over the skin areas for the 5th, 6th and 7th cervical segments; impaired but not absent over the 8th cervical and 1st thoracic skin area. The following day he was able to move his arms better; colour of face suffused. Unconscious for the last ten hours. Temperature rising. Breathing throughout mostly abdominal; almost complete intercostal paralysis.

X-ray report: Lateral view showed a fissured fracture of the body of the 3rd (?) cervical vertebra; the lumen of the canal at this level is only represented by a crescent-shaped area in the posterior and lower part, unlike the circular area opposite the vertebræ above and below; the fractured body appears to be pressing on the cord.

Survival: About sixty hours.

Post-mortem Result.—Head and neck: Fracture of the lamina and body of the 5th cervical vertebra; a little extradural hæmorrhage an inch or two below this site; at the site of fracture was a hole in the dura on each side, corresponding to the entry and exit of bullet. Spinal cord cut through.

CASE 40.—Asphyxia from Bleeding During Operation.

Clinical History.—Nature of wound: Gunshot wound, neck and mouth. (Bullet.)

Signs and symptoms: Admitted with a wound of the neck on each side just below the angle of the jaw, corresponding to entry and exit of bullet: bleeding.

Operation: As the pharynx was said to have been opened, it was decided to operate; he was given a general anæsthetic (chloroform). The wounds were opened and parts of the track excised; submaxillary gland found to be lacerated, and the bleeding was stopped with difficulty; whilst doing the other side (left) respirations became feebler and gradually ceased: colour never became very blue and did not suggest asphyxia. (He had previously lost much blood.) Tracheotomy was done, and fluid blood found in the trachea. He became worse, and died on the table.

Survival: Several hours.

Post-mortem Result.—Head and neck: Punctured wounds of both sides

of the neck and a track on the dorsum of the posterior portion of the tongue, which had been made by the bullet.

Chest: The larynx, trachea, bronchi and lungs contained much blood.

Comments: He had been bleeding from the tongue wound, and having lost the reflexes under the anæsthetic the blood went down the glottis, and so into the lungs; the patient was asphyxiated. It would not have happened if he had not been given a general anæsthetic, or, if under a general anæsthetic, care had been taken to keep the head and nasopharynx in a dependent position. Such things as suckers were, of course, unknown at the Front.

CASE 41.—Laceration of Brain.

Clinical History.—Nature of wound: Gunshot wound, head. (Shrapnel.)

Signs and symptoms: Admitted unconscious, having been struck on the head with a piece of shrapnel. There was a wound on the vertex; compound depressed fracture of the skull pretty well in the middle line, out of this is coming lacerated brain substance. Having frequent convulsions, especially of the left arm.

Operation: Under a local anæsthetic the wound was excised and then enlarged; there was a depressed comminuted fracture in the mid-line with lacerated brain exuding; portions of bone removed, and bone chipped away around the edges. Got worse during the operation.

Survival: Several hours.

Post-mortem Result.—Head: Sub-aponeurotic hæmorrhage for some distance from the wound; bluish appearance under the dura of both hemispheres due to an evenly-distributed subarachnoid extravasation. The longitudinal sinus had evidently been perforated as it was right in the track of the wound. The adjacent borders of the cerebral hemispheres were lacerated (? slightly in front of the motor areas), the right more so than the left; the laceration of the right side extended into the lateral ventricle which contained clotted blood. Deep down amidst the lacerated brain substance was a piece of shrapnel and a small piece of bone.

Comments: Cases with a rapid pulse rarely do any good (operation or not). Those with a slow pulse sometimes do well by operation.

(To be continued).

Current Literature.

WALDMANN, A. **German Medicine in the Last War.** *Münch. med. Wsch.*, 1934, **81**, 1157. *Lancet*, September 16, 1939.

Professor Waldmann was head of the German Army Medical Service and he promoted a special number of the *Munich Medical Journal* dealing with every aspect of military medicine. He states that of the 26,292 military doctors 1,783 (6.8 per cent) lost their lives, the proportion being highest (10 per cent) in doctors at the Front. They treated in all 27 million wounds and illnesses, of which 98·4 per cent survived and 95·8 became fit for service again. These convalescents numbered 67,000 men a month.

Waldmann estimates that the new hygiene and surgery kept alive a quarter million of men who would otherwise have been lost. Actually some 40 per cent of the men in the field were at no time ill or seriously wounded. The mortality from wounds was ten times that from disease. On the Western front the incidence of typhoid was seven times less in 1914-18 than in 1870-71, and one quarter as fatal. Smallpox and cholera were not in evidence and their place was taken by infectious jaundice, five-day fever and trench nephritis. Diabetes and gout disappeared and also scarlet fever. Venereal disease was only 7 per cent for the whole army and never reached the peace-time figure.

GILBERT, E. **Distance Factor in Gas Warfare.** *Med. Klin.*, August 11, 1939, and *Lancet*, September 30, 1939, p. 753.

The extent to which war gas will travel along the ground in dangerous concentrations is an important question not only for troops but also for auxiliary services. Wind currents will break up and dilute vapours, and the lighter a gas is the more quickly it is dispersed. Professor Gilbert of Berlin states that phosgene will not rise higher than fifty metres but will spread at an angle over 30°.

He gives a table which shows that a concentration of 1·4 per cent at the site of release may have thinned out to 0·004 at three thousand metres. In favourable circumstances phosgene may be effective more than twenty kilometres away and detectable up to thirty kilometres. The phosgene which escaped by accident in Hamburg in May, 1928, caused 130 casualties between two and seven kilometres away and was detected at fourteen kilometres.

If the air is still and humid, heavy insoluble gases may retain a high concentration at relatively long distances. In 1930 an escape of fluorine filled a part of the Meuse Valley over an area twenty-five kilometres long and one to two kilometres wide and caused sixty-three deaths in a single day. War gas hangs about obstinately in woods.

BACKHOUSE, T. C. **Hæmaturia during Treatment with M & B 693.** *Lancet*, September 30, 1939, p. 736.

In 109 cases of pneumonia in Melanesian natives treated with M & B 693, hæmaturia was found thirteen times. The hæmaturia was, as a rule, associated with characteristic crystals in the urine which were identified as a conjugated derivative of M & B 693. The suggestion is made that the hæmaturia is mechanical rather than toxic.

In a case without hæmaturia, small calculi were found obstructing both ureters.

Fluids and alkalis should be given liberally where treatment with M & B 693 is adopted to prevent the deposition of crystals.

ROYD-JONES, H. M. **Lobsters and Gastro-enteritis.** *Lancet*, September 30, 1939, p. 738.

Cooked lobsters sometimes cause gastro-enteritis. Pathogenic organisms are probably carried from the gut of the lobster to the flesh by the cook during preparation for serving. If a two-pound lobster is cooked in boiling water for forty-five instead of the usual twenty-five minutes the gut is satisfactorily sterilised and the taste is not affected. The internal temperature of a large lobster does not approach boiling point until it has been boiled forty-five minutes. If there is any doubt about how long lobsters have been cooked, it is safer to eat small one-pound lobsters which are more easily sterilized, or to confine oneself to the claws or to re-cooked lobsters.

ELLIOTT, S. D. **Bacteriæmia and Oral Sepsis.** *Proc. Roy. Soc. Med.* 1939, v. 32, 747–54 (*Sect. of Odontology*, 57–64). [11 refs.]

To add to the evidence, already accumulated, that there is some link between oral infections and bacteriæmia, S. D. Elliott made a series of experiments with the late C. C. Okell in 1935, in which they tested the blood in three classes of mouths before and after extraction. They were surprised to find streptococci in the blood in three cases before operation all of which exhibited severe gum infection. No organisms, however, were isolated from the blood before operation in cases of clean mouths. Another interesting point emerged, and that was that in three cases where streptococci were found in the blood both before and after extraction, six hours later a specimen taken was found to be sterile. The author argues from this that following extraction there is an inflammatory reaction which inhibits the absorption of organisms. A further point was that manipulation of the teeth or tooth during extraction, or a loose tooth during mastication, in a septic mouth sends a shower of organisms into the blood-stream. Other organisms besides the streptococcus isolated were *Staphylococcus albus* and diphtheroids; these, however, were never found in clean mouths, only in those with gum infections. The remote effects of dental operations in subjects with pre-existing abnormality of the joints or organs are discussed and illustrated by suggestive case histories of subacute infective endocarditis. The onset of sym-

ptoms varies from during the operation to nine weeks later. Prevention of bacteriæmia of dental origin has been advocated by dentists for the last fifty years; they recommend attention to oral hygiene, and the more recent advice to avoid dental extractions during acute attacks, but if operation be imperative to avoid "rocking" as much as possible, evidence of actual operations on patients with pyorrhœa is corroborative of this. A more recent precautionary measure is advocated—preliminary cauterization of the gum margin.

L. LINDSAY.

Reprinted from "Bulletin of Hygiene," Vol. 14, *No.* 8.

Reviews.

TREATMENT OF WAR WOUNDS AND FRACTURES. By J. Trueta, M.D. (Director of the Department of Surgery, General Hospital of Catalunya, Barcelona). London: Hamish Hamilton Medical Books. 1939. Pp. xiii + 143. Price 8s. 6d.

Most medical men have been wondering, during the last two years, whether experiences in the Spanish War would produce any innovations, or new methods of dealing with war casualties. We have had articles from time to time recently in medical journals which have whetted the appetite for information, and at last we have a small book (of 143 pages with 48 illustrations), concerning which Mr. Hey Groves, in his Foreword says: "Dr. Trueta has had a unique experience in just that kind of warfare for which we are all preparing and therefore his book comes at a most opportune time." We ourselves are again at war, so the publication of the book could hardly have been more opportune, and it is assured of success. In spite of the fact that Mr. Trueta has not in reality discovered anything new, he must be given credit for having demonstrated again the value of excision of wounds, free drainage of infected tissues, and immobilization of the part in closed plaster splints, applied so as to prevent œdema by their firm pressure. There is no doubt that many of the results he obtained are most striking. It is simply the Winnett Orr method with which all surgeons must be now familiar. But there are many practical tips, and an exception is made in the case of established anaerobic infection. To say more about the book would spoil the enjoyment with which it will be read.

D. C. M.

THE DYSENTERIC DISORDERS—THE DIAGNOSIS AND TREATMENT OF DYSENTERY, SPRUE, COLITIS AND OTHER DIARRHŒAS IN GENERAL PRACTICE. By Philip Manson-Bahr, C.M.G., D.S.O., M.D., F.R.C.P., with an Appendix by W. John Muggleton, M.S.M. London: Cassell and Co., Ltd. 1939. Pp. xiv + 613. Price 25s.

In the Introduction to this book by J. Johnston Abraham it is well said "This is a book that needed to be written."

The Dysenteric Symptom Complex is one that presents a wide, and very often difficult, field in clinical and laboratory investigation. The author has performed a signal service in collecting from his vast experience and knowledge such a wealth of information on the subject and placing it compactly within the compass of a volume of some 613 pages. The book supplies a long felt want and should prove invaluable to practitioners both at home and abroad. It is admirably arranged in sections with clear headings and sub-headings. There is a preliminary section dealing with the investigation of a case of diarrhœa or dysentery, and containing also a brief historical survey of the dysenteries, well illustrating the importance of careful examination.

The remaining sections are arranged according to the chief ætiological factor concerned, and it is not surprising to find that those sections which deal with bacillary dysentery, protozoal dysentery, sprue, and ulcerative colitis comprise the bulk of the book.

In the section on ulcerative colitis the author sets out fairly the various theories concerning ætiology, shows how controversial the subject is, and finally puts forward the theory that it is due to the excretion of toxins through the intestinal mucosa. The nature of these toxins and the site of their elaboration are points which are not made quite clear.

Illustrations are clear and plentiful and the plates, of which there are twenty-three, well illustrate the points made in the text. The coloured plates are particularly notable.

Finally, the appendices on intestinal protozoa and laboratory methods, along with an exhaustive bibliography, put the finishing touch to an excellent publication which should assuredly become as well known as the author's book on tropical medicine and can be confidently recommended to the notice of all. W. A. R. R.

Sanitary Law in Question and Answer. (For the use of students of Public Health.) By Charles Porter, M.D., B.Sc., M.R.C.P.Ed., and James Fenton, C.B.E., M.D., M.R.C.P., D.P.H. Fourth Edition. London: H. K. Lewis and Co., Ltd. Pp. xvi + 352. Price 10s. net.

The manifold changes which have occurred in connexion with Sanitary Law in this country in the past few years cause the advent of the fourth edition of this valuable book to be received with genuine relief by all those interested in the subject.

The pious hope of the authors that with the apparent simplification of Sanitary Law by the various consolidatory measures of recent years they might be able to reduce the bulk of the book has unfortunately been frustrated but through no fault of theirs.

The book is a mine of information, the subject matter is well set out in a useful form, and the volume is an essential one for all those engaged in the study or practice of Public Health.

A Dictionary of Malayan Medicine. By John D. Gimlette, edited and completed by H. W. Thompson. Humphrey Milford, Oxford University Press. 1939. Pp. 259. 2 plates. Price 7s. 6d.

Dr. Gimlette, a well-known and popular member of the Medical Service of the Malayan Government, is already known to us as the author of Malay Poisons and Charm Cures, the material for which he obtained first-hand from the Malayan healers who practised the healing art which had been handed down to them from one generation to another. In 1934, whilst engaged on this work which by this time was well advanced, the author unfortunately died and his friend and colleague, Dr. H. W. Thompson, aided by Gimlette's rough notes, has written the remainder and has been responsible for its publication. As its title denotes it is a Malay-English dictionary and gives the names of ailments together with a description of their remedies which have been and are at present used by native practitioners. Although one does not normally read a dictionary from cover to cover yet a perusal of some of the descriptions reminds the reader that nearly three centuries ago similar ideas were held in this country, for example we find that *embun* means dew and we read that dew collected before sunrise is held in favour in Sumatra as a beautifier to the complexion of the fair sex. As a comparison, Pepys in his diary notes : "My wife away, down to Woolwich to gather May-dew tomorrow morning . . . to wash her face with." Again, the concoction of the witches in *Macbeth* has its counterpart in Malayan medicine, for we learn that the medicine recommended for the treatment of gluttony described under *apiun* consists of opium, gall-nut, nutmeg, catechu, dragon's blood, pomegranate-blossom, salt, garlic, shallot, peppercorns, red sandal wood, ebony, teakwood and a little cinnamon bark, all rubbed finely down, mixed with honey and made into pills !

The two plates representing the anterior and posterior aspects of the human skeleton ably demonstrate the skeletal anatomy in the Malayan tongue. For easy reference an English-Malay dictionary has been added thereby making this very informative dictionary invaluable to medical practitioners in Malaya, especially to those who are new to the country. The book is of convenient size and the type is beautifully clear. Sir Malcolm Watson has contributed a foreword containing an appreciation of "John D.," as he was known by many, and the good work he did in Malaya. L. P.

Tropical Medicine. By Sir Leonard Rogers and Sir John W. D. Megaw. Third Edition. London : J. and A. Churchill. Pp. 544. 2 coloured plates ; 87 figures. Price 16s.

This, the third edition, follows on the lines of its predecessor of 1935, but, although much new material has been added, there has been no increase in size of the book, partly due to excision and also in part to the co-operation of the publishers. The authors do not claim it to be a comprehensive work on tropical medicine but for the student and practitioner its help will be

invaluable because therein will be found all the information that is required concerning the usual diseases likely to be met with in the tropics. Recent advances have been added in connexion with leprosy, trypanosomiasis, malaria, deficiency diseases, the typhus group of fevers, yellow fever, cholera and schistosomiasis, so that the work can be regarded as completely up to date. Reference is made where necessary to the latest forms of chemotherapy such as by nicotinic acid and the sulphonamide group of drugs but there is, however, no reference to these drugs in the index. This, however, in no way detracts from an informative treatise on the more important subjects in the field of tropical medicine, for it will always remain an excellent textbook for the student and a very reliable guide to the practitioner abroad.

R. P.

FRACTURE EQUIPMENT. By London Splint Co.

This is a well-illustrated catalogue of 60 pp. in which will be found all kinds of apparatus for the treatment of fractures. Many of the items should interest surgeons of a mechanical turn of mind. J. W.

THE ABDOMINAL INJURIES OF WARFARE. By Gordon Gordon-Taylor, O.B.E., M.A., F.R.C.S. Bristol: John Wright and Sons, Ltd. Pp. 87 and 68 illustrations. Price 10s. 6d.

It is just like Gordon-Taylor to dedicate this excellent and most opportune book to " My colleagues, the Casualty Clearing Surgeons of the Franco-British Western Front 1914-1918," and as a colleague who was privileged to work at an adjoining table in the same unit, it is rather difficult for the reviewer to subdue his personal interest in the book, or a tendency to indulge in superlatives, when his object should be merely to indicate its merits or defects, and attempt to assess its usefulness to the profession.

Quoting two lines from Lucan's " Pharsalia " :

> " Why did a maddened people rush to arms
> And rob the world of peace."

Gordon-Taylor truly states that " Surgeons who have had first-hand experience of abdominal lesions . . . must feel dismay at any fresh prospect of traumatic surgery. . . " and then expresses his belief that a " small book of illustrations depicting war injuries of the abdomen might be timely, and not without value to those of more youthful years than the generation of surgeons who participated in the last European conflict."

This book should certainly fulfil its purpose. There is a useful chapter on shock, anæsthesia, radiography and operative technique, to start with, and the various viscera are dealt with systematically. The illustrations are first class.

Some statements may be briefly mentioned, in order to accentuate them.

We are warned against gum-saline infusions.

Although nitrous oxide-oxygen is usually the anæsthetic of choice in these cases, it can be a great handicap to the surgeon if indifferently administered. (Memories of cyanosis, and constant venous oozing in the "field"!)

The value of supplementary regional or local anæsthesia.

The danger of spinal anæsthesia. (What a pity it is so ?)

Selection of cases for operation—excluding those "Too late, too bad or too high."

Deal with wounds in the back first.

It is hæmorrhage that kills in the first twenty-four hours.

Many other points come to mind, and remind one of old problems and discussions, in those years of the "War to end Wars ?"

If you are likely to be faced with abdominal problems in warfare I advise you to read this book and this advice is given irrespective of what experience you may have had of surgery in civil life. D. C. M.

BLOOD TRANSFUSION. By Victor Horsley Riddell, M.A., M.B.(Camb.). F.R.C.S.Eng. London: Oxford University Press, Humphrey Milford. 1939. Pp. xvi + 370. Numerous illustrations. Price 21s.

It is not so many years ago since the Army possessed a few sets of pairs of small silver cannulæ and connecting tubing in case one of the more ambitious or more skilled surgeons of those times might feel tempted or called upon to carry out a direct blood transfusion. One can almost see the face of the no longer choleric Colonel Blimp, as his blanched retinæ tried to focus the feet of the volunteer donor, lying on the adjoining stretcher. while his failing consciousness attempted to inquire why his arm and wrist were being bandaged or held firmly to someone else's. The donor was usually a relative, whose acquiescence in such a manœuvre might have been calculated to inspire confidence, but it would not be difficult to imagine that the colonel treated the whole procedure with scepticism and mistrust. Doubtless the "dope" he had had, and increasing breathlessness and muscular weakness, produced but a feeble protest, and, resigning himself to his fate, he permitted the "leeches" to carry on with their extraordinary procedure. Let us hope that there was no sudden reaction in the patient when the donor's blood began to make him tingle all over, and the gallant officer recovered. From those days to the Great War seems but a step. The reviewer first saw whole blood transfusion carried out by members of the Harvard Unit at a C.C.S. in 1916. The paraffin coated Kimpton tube acted well; soon afterwards the administration of citrated blood by one of the older methods was becoming a commonplace. Not till after that war did the Army during peaceful times keep lists of typed volunteer donors who could be called upon when necessary. In the interval much research has been carried out, and the possibility of using stored or cadaver blood investigated. During the recent fighting in Spain experience accumulated and the Blood Transfusion Service of the

Republican Armies did life-saving work. We are again involved in a major war, and the result of accumulated experience and investigation has borne fruit. Well organized Blood Transfusion Services, both civilian and for the Army, now exist, and we can look forward with confidence to saving many lives by the timely administration of blood, and certainly to adding to our knowledge of all that pertains to the operation. The Army has not been slow to pick the brains of all British authorities on the subject, and Dr. Riddell was one of them. In the very excellent book he has just published—the first on this subject for twenty years—he has left nothing of value unsaid. He draws attention to " the grave danger of circulatory failure in transfusing anæmias of long standing, and to the principles governing the rate of introduction and dosage of blood, as altered conceptions in regard to these matters form the two most important advances in blood transfusion of recent years."

Both he and the publishers are to congratulated, not only on this excellent publication, but on its timely release. The text is beautifully illustrated, and contains numerous references. D. C. M.

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No. 6. December, 1939. Vol. LXXIII.

Journal OF THE Royal Army Medical Corps

IN ARDUIS FIDELIS

ISSUED MONTHLY

EDITOR.
COLONEL SIR WILLIAM H. HORROCKS, K.C.M.G., C.B.

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Price Two Shillings and Sixpence net

Vol. LXXIII. December, 1939. No. 6

Journal
of the
Royal Army Medical Corps.

Original Communications.

THE SEASONAL INCIDENCE OF DYSENTERY IN INDIA AMONGST MILITARY PERSONNEL.

By Lieutenant-Colonel T. O. THOMPSON,
Royal Army Medical Corps,

AND

Lieutenant-Colonel C. D. M. BUCKLEY, *M.C.*,
Royal Army Medical Corps.

Owing to somewhat misleading information which has recently appeared, the seasonal incidence of dysentery in India seems to be worth consideration, particularly in its bearing on ætiology and prevention.

It is noted that in the records of the proceedings of the May, 1938, Session of the Office International d'Hygiene Publique, Paris, the statement has been made: "that as regards the incidence of dysentery in British India there is little information; but that dysentery is observed mainly from November to January."[1] This statement appears to be based on information supplied by the Director of the School of Tropical Medicine, Calcutta, with special reference to Calcutta.

That such a statement cannot be held to be true for the greater part of India and that it gives a completely erroneous picture of the case can, we think, be clearly demonstrated from the records of dysentery amongst military personnel throughout India.

It should be explained for the information of those who are not familiar with Indian conditions that military personnel, British and Indian, and their wives and families, live in cantonments or plots of military land placed close

[1] *Bulletin of Hygiene*, September, 1938, **13**, No. 9, p. 690.

to large populous cities and towns, and that these cantonments are scattered throughout the whole length and breadth of the country. Outside the cantonment military sanitation has no jurisdiction.

The term "*dysentery*" as employed is, however, a generic term which includes true bacillary dysentery, proved by laboratory findings; probable bacillary dysentery shown by microscopical examination as "bacillary exudate"; cases diagnosed as "clinical dysentery"; "diarrhœa," many of which cases are certainly bacillary in origin; "colitis," under which a number of doubtful cases are included; and finally protozoal (amœbic) dysentery.

If all these are caused in the same way, and if the method of transmission is the same, then the seasonal incidence would be the same for all.

The numbers and proportions of the different categories mentioned above

TABLE I.—INCIDENCE OF DYSENTERY, DIARRHŒA, COLITIS, AND AMŒBIC HEPATITIS DURING 1933–37.

Year		Dysentery		Diarrhœa		Colitis		Total		Amœbic hepatitis		Liver abscess	
		Admissions	Ratio per 1,000	Admissions	Ratio per 1,000	Admissions	Ratio per 1,000	Admissions	Ratio per 1,000	Admissions	Ratio per 1,000	Admissions	Ratio per 1,000
1933	B.O.Rs. ..	1,369	24·9	842	15·3	53	1·0	2,264	41·2	36	0·65	7	0·13
	I.Os. & I.O.Rs.	1,804	15·3	933	7·9	30	0·3	2,767	23·5	*	*	3	0·03
1934	B.O.Rs. ..	1,389	25·5	811	14·9	42	0·8	2,242	41·2	52	0·96	5	0·09
	I.Os. & I.O.Rs.	1,632	13 9	742	6·3	28	0·2	2,402	20·5	*	*	8	[illegible]
1935	B.O.Rs. ..	1,536	29·2	734	13·9	19	0·4	2,289	43·5	24	0·46	4	[illegible]
	I.Os. & I.O.Rs.	1,424	12·2	651	5·6	21	0·2	2,096	17·9	*	*	6	[illegible]
1936	B.O.Rs. ..	1,283	24·6	859	16·5	49	0·9	2,191	42·1	15	0·29	2	0·04
	I.Os. & I.O.Rs.	1,277	11·0	726	6·2	39	0·3	2,042	17·5	*	*	3	0·03
1937	B.O.Rs. ..	1,209	25·5	762	16·1	14	0·3	1,985	41·9	11	0·23	3	[illegible]
	I.Os. & I.O.Rs.	1,226	12·4	535	5·4	44	0·4	1,805	18·3	*	*	3	[illegible]

* Information for I.Os. & I.O.Rs. not available.

TABLE II.

		1935		1936		1937	
		Admissions	Percentage	Admissions	Percentage	Admissions	Percentage
Dysentery protozoal ..	B.O.Rs.	158	10·8	138	10·8	126	10·4
	I.Os. & I.O.Rs.	50	3·5	75	5·9	75	6·1
Dysentery bacillary (bacteriologically proved)	B.O.Rs.	637	41·5	592	46·1	596	49·3
	I.Os. & I.O.Rs.	592	41·6	652	51·1	651	53·1
Dysentery bacillary exudate (typical exudate but no organism isolated)	B.O.Rs.	353	23·0	288	22·4	237	19·6
	I.Os. & I.O.Rs.	407	28·6	316	24·8	247	20·2
Dysentery clinical ..	B.O.Rs.	388	25·3	265	20·7	250	20·7
	I.Os. & I.O.Rs.	375	26·3	234	18·3	253	20·6

vary from time to time, but the totals are fairly constant, as shown by Tables I and II. With improvements in technique in the collection and dispatch of material from hospital wards to laboratories, the proportions of laboratory proved cases to "exudate," "clinical," and "diarrhœa" cases has steadily increased.

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TABLE III.—DYSENTERY ADMISSION RATIOS PER 1,000.

Commands		Bacillary		Bacillary exudate		Protozoal		Clinical		Total	
		1936	1937	1936	1937	1936	1937	1936	1937	1936	1937
Northern	B.O.Rs.	6·9	8·6	4·0	3·4	1·8	1·9	8·1	7·2	20·9	21·0
	I.Os. & I.O.Rs.	4·6	5·7	2·3	1·8	0·5	0·7	2·3	3·3	9·7	11·2
Western	B.O.Rs.	12·5	11·2	5·0	6·7	2·5	1·5	15·3	8·5	35·3	27·9
	I.Os. & I.O.Rs.	2·3	3·6	2·1	2·9	0·3	0·5	2·6	3·4	7·3	10·5
Eastern	B.O.Rs.	13·8	15·8	6·5	4·2	3·3	3·6	4·0	5·5	27·7	29·0
	I.Os. & I.O.Rs.	6·1	7·2	3·0	2·1	0·5	0·9	1·7	1·4	11·3	11·6
Southern	B.O.Rs.	14·0	13·5	6·3	7·0	2·3	2·8	0·8	2·3	23·4	18·5
	I.Os. & I.O.Rs.	10·0	10·2	3·2	4·3	0·7	0·9	1·0	1·8	14·9	17·2

Within the proved bacillary group there are distinct types of causal organisms. Recent work by Boyd and others has considerably clarified the serological grouping of dysentery organisms and their relation to case incidence. By means of biochemical reactions organisms are first divided into main groups, and afterwards are identified as to type by means of agglutination and absorption tests with specific sera.

Table IV shows the distribution of the various strains throughout India during the year 1937.

The new strains mentioned above have definitely been established in military work over a series of years, but do not appear to have received due recognition in civil medical circles in India. Presumably this is due to the fact that absorption tests or employment of specific type sera are necessary for their identification.

A study of the different types amongst military personnel shows that there are occasionally groups of connected cases of the same type, which therefore may be viewed as coming from a common source of infection. But much more frequently close analysis of the types shows great diversity of infecting organisms. Therefore it may be concluded that infections which appear amongst military personnel are due to a constant bombardment of that personnel by infections from a massive reservoir of types existing

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Western	B.O.Rs.	12·5	11·2	5·0	6·7	2·5	1·5	15·3	8·5	35·3	27·9
	I.Os. & I.O.Rs.	2·3	3·6	2·1	2·9	0·3	0·5	2·6	3·4	7·3	10·5
Eastern	B.O.Rs.	13·8	15·8	6·5	4·2	3·3	3·6	4·0	5·5	27·7	29·0
	I.Os. & I.O.Rs.	6·1	7·2	3·0	2·1	0·5	0·9	1·7	1·4	11·3	11·6
Southern	B.O.Rs.	14·0	13·5	6·3	7·0	2 3	2·8	0 8	2·3	23·4	18·5
	I.Os. & I.O.Rs.	10·0	10·2	3·2	4·3	0·7	0·9	1·0	1·8	14·9	17·2

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TABLE IV.—ANALYSIS OF TYPES OF DYSENTERY BACILLI ISOLATED DURING 1937.

Commands and Laboratories	Group A 1 *B. flexner* Andrews' strains V, W, X, Z, Y, etc.	Group A 2 Boyd's strains 103, 170, 119	Group B Boyd's strains 88, 288, P 274, D 1 and D 19	Group C *B. sonne*	*B. shiga*	*B. schmitz*
NORTHERN—						
Kasauli	5	1	8	17	—	2
Peshawar	41	28	29	18	17	10
Kohat	27	6	11	6	11	1
Razmak	131	37	34	27	10	10
Rawalpindi ..	49	16	22	26	7	9
Lahore	40	1	2	9	42	1
Bannu	80	6	7	5	20	12
Sialkot	12	1	—	12	—	1
Ambala	37	1	4	7	5	—
Abbottabad ..	18	2	—	2	1	1
Total ..	440	99	117	129	113	47
SOUTHERN—						
Poona	92	18	16	69	31	21
Colaba	13	—	4	4	2	—
Bangalore ..	46	4	7	18	9	4
Trimulgherry ..	65	28	14	44	6	17
Jubbulpore ..	33	1	3	6	18	8
Mhow	11	—	—	6	1	1
Nasirabad ..	13	—	—	3	4	4
Total ..	273	51	44	150	71	55
WESTERN—						
Quetta	23	11	8	34	5	1
Karachi	31	—	2	19	—	—
Total ..	54	11	10	53	5	1
EASTERN—						
Meerut	43	31	16	18	14	11
Lucknow	66	27	26	26	18	17
Calcutta	23	4	6	23	6	1
Bareilly	14	7	4	10	—	6
Dehra Dun ..	15	—	4	16	4	8
Jhansi	40	3	11	25	10	15
Allahabad ..	21	1	—	10	5	2
Total ..	222	73	67	128	57	60
Total All-India 1937	989	234	238	460	246	163
Total All-India 1936	814	177	206	337	261	131

among the civil population. In the absence of effective inoculation the only hope of prevention is to raise the standard of civil sanitation.

But although the distribution of types varies somewhat, yet the method of transmission, and therefore the seasonal incidence of the varieties, is probably the same. Cases of bacillary exudate and clinical dysentery may, we think, be regarded as synonymous with bacillary dysentery, and the method of transmission and seasonal incidence of all this group can be looked on as similar.

Protozoal (*amœbic*) *dysentery*, however, appears more and more to be on a

different footing. This may therefore be discussed and disposed of at once. These protozoal cases show but little regular seasonal incidence and are also surprisingly constant in total numbers in the various Commands. On the supposition that fly transmission plays a part in *some* cases of this infection, a seasonal incidence coincident with fly prevalence should be found, and this is found to be so in certain years only—*see* Table V. But there has been a steady and noticeable decrease of the numbers as a whole over the past eighteen years, while cases of hepatitis and of abscess of the liver are becoming less and less common amongst troops (*vide* Table I).

During the seven-year period 1920–1926 the average of cases per annum of these diseases was 30·6, with an average of 8·4 deaths in each year. During the next seven-year period the average dropped to 9·8 cases and 1·2 deaths.

The only marked sanitary improvement which has taken place *pari passu* with this fall in protozoal infections, and to which it seems possible to ascribe this change, is the chlorination of water supplies. It seems that the chlorination of water must have a greater effect on the cysts of hæmolytica than is generally supposed, and that water may well be the normal transmitting agency.

There is no doubt, however, that flies do play a part in the transmission of the protozoal disease. In the Army it is the custom for all Indian personnel who are connected in any way with the handling of food for troops to be examined for a carrier condition prior to employment. These " food handlers " may be taken to be representative of the Indian population in general as they come from all parts of the country and are employed in all Commands. The results of these examinations are interesting in that the percentage of carriers found is surprisingly low. During the years 1937 and 1938 a total of 54,759 examinations of this nature were carried out with positive protozoal findings in 227 cases only.

As far as *bacillary dysentery* is concerned, including all categories and types, the constant comment in the annual reports of hygiene officers and in the annual reports of the Public Health Commissioner with the Government of India on the health of the Army in India is to the effect that the incidence of the disease in any military community depends on the proximity of that community to bazaar or city areas, which breed flies and provide the focus of infection by means of insanitary conditions and the presence of multiple cases of the disease.

The following extracts and quotations from various reports will give a clear picture of the opinion of hygiene officers.

The Public Health Commissioner's report for 1935 states :—

> " Dysentery cases were, as usual, sporadic in occurrence, the main incidence corresponding with the fly season. There were no epidemics with the exception of a small outbreak . . . in Lahore . . . caused by *B. sonne*. . . . A small outbreak among the Indian platoon . . . in Burma is of interest in that one of the newly-

discovered strains of dysentery bacilli (known in India at the moment as P.288) was isolated in practically pure culture from every case."

"It requires, however, to be realized that in the majority of stations in India the method of disposal of excreta is still by means of the bucket (fly-proofed in British lines)—sweeper—and incineration method . . . while in a few cases the most unsatisfactory method of cartage and burial of excreta is still in vogue. . . . Barracks and cantonments are frequently sited within easy fly range of cities, municipal areas, villages and bazaars. At certain times of the year flies swarm into the military areas from these places. . . ."

"One of the striking features of the post-earthquake period in Quetta was a dramatic fall in the dysentery incidence among the troops in the station. For several years previously the incidence in this station had been high, and increasing in spite of the most stringent precautions in the military area."

In the Annual Report for the Health of the Army 1936 the following comments are made :—

"As usual the cases were sporadic and no epidemic occurred. The greatest incidence corresponded with the fly season, and in the Northern Command it was noticed that units which had recently arrived at their stations after train journeys produced small crops of cases. The fact that under peace conditions this group of diseases is largely passed on from the insanitary conditions prevailing among the civil community was stressed in the 1935 report."

For 1937 the Annual Report on the Health of Troops in India contains similar references to the association of military dysentery cases with fly infested civilian areas.

"In Quetta investigations . . . were made. In brief they consisted in the bacteriological examination of casual specimens of mucus from bazaar and servants latrines . . . dysentery bacilli were isolated from the majority of these specimens and the location of the dysentery cases in barracks corresponded to the prevalence of flies. . . . In these bazaars flies not only breed freely, but find ample opportunity for disseminating dysentery and diarrhœa by feeding alternatively on human fæces and human food. . . . Certain hill stations have acquired in the past a poor reputation among families owing to the occurrence of this group of diseases among the children. Here again these conservancy arrangements in the bazaars are considered to be the main sources of infection. . . ."

It is obvious from these extracts that the general opinion of experienced hygiene officers is that dysentery infections are fly-borne, and that the incidence of cases is closely associated with fly prevalence. Further, that military populations are nearly always dependent for infection on the associated civil populations and that the incidence and occurrence of cases

TABLE V.—MONTHLY INCIDENCE OF DYSENTERY AND DIARRHŒA FOR B.O.Rs., I.Os. AND I.O.Rs. RATIOS PER 1,000 OF STRENGTH.

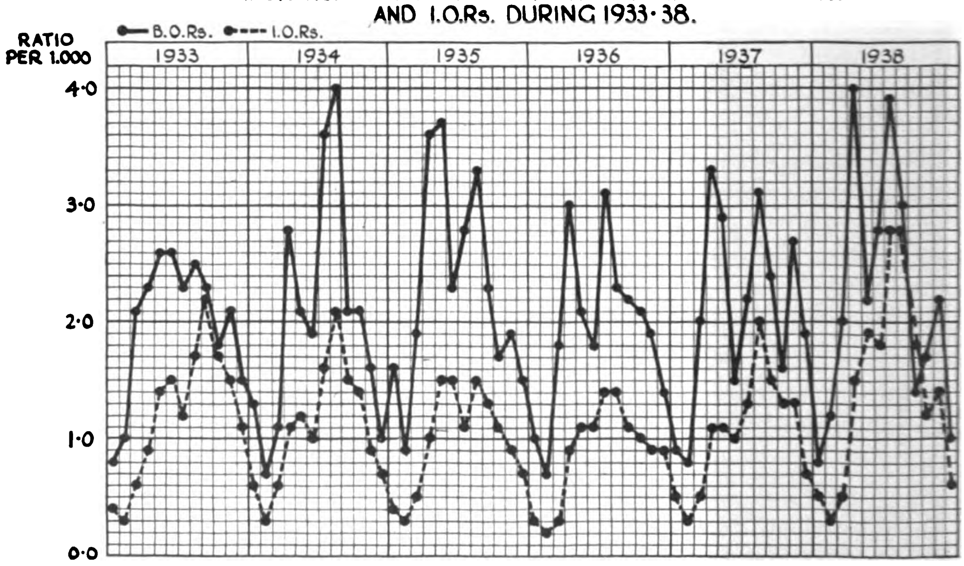
Month		1932			1933			1934			1935			1936			1937		
		Dysentery bacillary	Diarrhœa	Dysentery protozoal	Dysentery bacillary	Diarrhœa	Dysentery protozoal	Dysentery bacillary	Diarrhœa	Dysentery protozoal	Dysentery bacillary	Diarrhœa	Dysentery protozoal	Dysentery bacillary	Diarrhœa	Dysentery protozoal	Dysentery bacillary	Diarrhœa	Dysentery protozoal
January	B.O.Rs.	0·9	0·7	0·2	0·6	0·6	0·2	1·1	0·8	0·1	1·4	0·5	0·2	0·8	0·4	0·2	0·8	0·8	0·1
	I.Os. & I.O.Rs.	0·5	0·2	0·0	0·4	0·2	0·0	0·5	0·3	0·1	0·4	0·3	—	0·4	0·3	0·0	0·4	0·2	0·0
February	B.O.Rs.	0·9	0·7	0·1	0·9	0·9	0·1	0·7	0·4	0·1	0·8	0·6	0·2	0·7	0·6	0·1	0·6	0·7	0·2
	I.Os. & I.O.Rs.	0·4	0·2	0·1	0·3	0·2	0·0	0·3	0·2	0·0	0·3	0·1	0·0	0·3	0·3	0·0	0·1	0·1	0·1
March	B.O.Rs.	1·4	1·0	0·1	2·0	0·9	0·1	1·0	1·2	0·2	1·7	0·8	0·1	1·6	1·4	0·2	1·9	1·3	0·2
	I.Os. & I.O.Rs.	0·6	0·3	0·1	0·6	0·2	0·0	0·6	0·3	0·0	0·5	0·3	0·1	0·3	0·3	0·0	0·5	0·3	—
April	B.O.Rs.	2·3	1·2	0·3	2·0	2·6	0·3	2·6	2·3	0·3	3·4	1·3	0·2	2·7	2·7	0·3	3·1	3·0	0·4
	I.Os. & I.O.Rs.	1·1	0·6	0·1	0·9	0·4	0·0	1·1	0·8	0·1	1·1	0·4	0·0	0·9	0·6	0·0	1·0	0·5	0·1
May	B.O.Rs.	1·4	1·2	0·1	2·2	2·0	0·4	1·8	1·3	0·3	3·5	2·0	0·4	2·1	2·1	0·2	2·7	2·1	0·3
	I.Os. & I.O.Rs.	1·3	0·8	0·1	1·3	0·8	0·1	1·1	0·7	0·1	1·6	0·9	0·0	1·0	0·9	0·1	1·1	0·7	0·1
June	B.O.Rs.	1·1	0·7	0·3	2·4	1·2	0·2	1·8	1·1	0·2	2·2	1·3	0·2	1·7	1·5	0·1	1·5	1·1	0·2
	I.Os. & I.O.Rs.	0·8	0·7	0·2	1·4	0·7	0·1	1·0	0·5	0·1	1·5	0·8	0·1	1·1	0·8	0·1	1·1	0·6	0·1
July	B.O.Rs.	1·9	1·1	0·2	1·9	1·2	0·3	3·5	1·8	0·4	2·7	1·5	0·3	3·0	2·0	0·2	2·1	1·3	0·2
	I.Os. & I.O.Rs.	1·3	0·5	0·2	1·1	0·8	0·1	1·7	0·7	0·1	1·1	0·5	0·0	1·4	0·6	0·1	1·3	0·6	0·1
August	B.O.Rs.	4·1	1·8	0·7	2·1	1·5	0·4	3·8	2·0	0·4	3·1	2·7	0·3	2·2	1·7	0·2	3·1	2·2	0·3
	I.Os. & I.O.Rs.	2·7	0·9	0·5	1·6	0·8	0·1	2·2	1·1	0·1	1·5	0·6	0·0	1·4	0·8	0·1	1·9	1·0	0·1
September	B.O.Rs.	2·0	1·2	0·7	2·0	1·3	0·3	1·9	1·1	0·3	2·0	1·1	0·3	2·0	0·9	0·2	2·2	1·2	0·2
	I.Os. & I.O.Rs.	1·9	0·8	0·5	2·0	0·9	0·1	1·5	0·7	0·1	1·3	0·6	0·0	1·1	0·5	0·0	1·6	0·6	0·1
October	B.O.Rs.	1·3	0·9	0·4	1·7	0·8	0·2	1·8	0·9	0·4	1·4	0·9	0·2	1·9	0·9	0·2	1·5	0·6	0·1
	I.Os. & I.O.Rs.	1·1	0·5	0·1	1·6	1·2	0·1	1·5	0·5	0·0	1·0	0·5	0·1	1·0	0·4	0·1	1·1	0·4	0·1
November	B.O.Rs.	1·6	1·1	0·4	1·9	1·0	0·2	1·4	0·8	0·2	1·7	0·7	0·3	1·7	1·2	0·2	2·5	1·1	0·3
	I.Os. & I.O.Rs.	1·2	0·5	0·0	1·5	0·8	0·0	0·9	0·5	0·0	0·9	0·4	0·0	0·8	0·5	0·1	1·2	0·4	0·1
December	B.O.Rs.	1·5	1·1	0·1	1·2	1·0	0·2	0·9	0·9	0·1	1·4	0·5	0·2	1·2	0·9	0·2	1·7	0·6	0·2
	I.Os. & I.O.Rs.	0·8	0·3	0·1	1·0	0·6	0·1	0·8	0·2	0·0	0·7	0·3	0·0	0·8	0·4	0·1	0·7	0·3	0·1
Total of the year	B.O.Rs.	20·2	12·7	3·6	20·7	15·1	3·1	22·3	14·7	3·0	25·5	14·1	2·8	21·8	16·4	2·5	23·1	16·1	2·5
	I.Os. & I.O.Rs.	13·7	6·1	2·0	13·5	7·7	0·7	13·1	6·3	0·7	11·7	5·6	0·4	10·3	6·2	0·6	11·6	5·4	0·8

Dysentery bacillary includes dysentery bacillary exudate and clinical dysentery group.

in the military population is a true though miniature reflection of the state of affairs in the civil population.

It is well recognized that fly prevalence is a very variable factor, depending principally on warmth plus humidity and the necessary insanitary conditions. Great dryness or great heat are adverse factors which reduce fly breeding, a point which accounts for the reduction in the incidence of fly-borne dysentery cases in certain hot weather months in the drier stations. The presence of appropriate warmth and moisture is then the decisive factor in the seasonal prevalence of dysentery, it being taken for granted that conditions of sanitation are such that breeding of the vector, the fly, is always possible over very wide areas throughout the country.

MONTHLY INCIDENCE OF DYSENTERY AMONGST B.O.Rs. AND I.O.Rs. DURING 1933-38.



Therefore, when warmth and moisture are suitable, that will be the time of seasonal incidence of dysentery. This naturally will vary with the location, north or south India, and with the altitude of hill stations, but in the main the season will be the warm moist months of July to September.

A comment on the seasonal incidence of dysentery from the report for 1937 from the Eastern Command, which includes the Calcutta area, is worth quoting in this respect in view of the statement referred to at the beginning of this article.

> " The vagaries of the monsoon this year were such as to be favourable to fly breeding in certain stations and inhibit it in others. The months of maximum incidence in the various districts were as follows :—
>
> " Presidency and Assam District (includes Calcutta) : March, July, August.

Meerut District : April, May, August.
Delhi Area : March, August.
Lucknow District : March, April, July, August, September."

For all India the Table on page 339 compounded from the annual reports of the Public Health Commissioner with the Government of India for the six-year period 1932–1937 shows clearly how the seasonal incidence favours the warmer months, and is greatest in May to September with February the healthiest month.

This is shown even more clearly in the chart for troops in the years 1933–1938 (p. 340).

It will be noted that in nearly all years there is a double peak, the first about May and the second about August ; corresponding with the periods of greatest fly prevalence, and that February is in each year the healthiest month and the period November to March has the lowest incidence.

Clearly the seasonal incidence of dysentery for military populations throughout India, which may very well be taken as a typical sample of the whole population at risk, is not greatest in the winter months as stated in the report quoted in our opening paragraph, but in the hot weather months when moisture and other factors favour the breeding of the transmitting agent, the fly.

BACILLARY DYSENTERY.

The Significance of the "Inagglutinable Flexner" in the Light of Recent Investigations.

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During recent years the work of Sonne (1915), Aoki (1921, 1923), Clayton and Warren (1929), Sartorius and Reploh (1932), and especially Boyd (1931, 1932, 1936, 1938) has greatly clarified the ætiological position of the mannite-fermenting organisms isolated from dysentery cases. The now recognized types, identified by serological methods, account for over 98 per cent of all the Flexner-like bacilli cultivated from the stools of patients in India suffering from dysentery. And there is little doubt that these classified bacteria are true ætiological agents in the causation of the disease.

The position of one of the types described by Boyd—D19—still remains, however, in doubt. The reported isolations of this organism have been very infrequent and no fresh strain has been recovered in India during the last four years. When the original culture was re-examined in 1936 it was found to be irreversibly rough and to be serologically identical with the rough phase of *Bact. dysenteriæ* Sonne. It is felt that its occurrence, therefore, may be even rarer than the reports would indicate.

In addition to the recognized types a small group of serologically unrelated Flexner-like organisms is met very occasionally in the stools of dysentery cases in India, whose significance remains in doubt. Nearly 2,000 strains of Flexner-like organisms undergo serological investigation every year, and during the last three years only nine of these rare types have been encountered (type 83 once, type 1063 three times, type 197 twice, type 953 three times). And during this period no other new types have been found where the evidence was sufficient to pronounce them as causative organisms of dysentery. On the other hand, considerable numbers of cultures of Flexner-like bacilli, cultivated from the stools of dysentery patients, have been received for detailed investigation on the grounds that they failed to react with any of the group or type sera prepared and issued by the present writer.

It is this group, representing about 1 per cent of the mannite-fermenting bacilli isolated during the routine examination of dysentery stools, that forms the subject of this communication.

Origin of the Strains.

In the first place it should be stated that all cultures received in this laboratory are accompanied by a pro-forma which not only allows for a full

description of the organism itself, but also brief clinical notes, and with regard to dysentery bacilli, a description of the stool originating the culture. The clinical account, at the very best, is always second-hand, and the information regarding the date of onset, etc., is sometimes inaccurate and verification difficult.

All the strains were isolated from dysentery patients who were passing stools containing muco-pus with or without blood. In over 50 per cent of the cases the organism had been isolated from a specimen passed at least seventy-two hours after the onset of the disease. When it is appreciated how few dysentery patients come under observation early on in the disease it is considered that of the 30 per cent said to have been passed during the first twenty-four hours only a small proportion were really early stools. In no case had a recognized dysentery organism been recovered.

Character of the Strains.

The cultures, without exception, were smooth, delicately growing organisms producing small translucent non-lactose fermenting colonies on litmus-lactose-agar. Their biochemical reactions, after several days' incubation, were those of the Flexner group. However, after prolonged incubation a considerable proportion (28 out of the 40 strains investigated) fermented lactose and saccharose between the twelfth and twenty-fifth day. With lemco-broth media (Dudgeon and Pulvertaft, 1927), this period was shortened in some cases to six days, and three of the strains produced gas in the broth media where none could be detected in the ordinary peptone water. All these strains produced indol. They had already been tested against the type sera of all the recognized members of the Flexner-Sonne group as well as many sera prepared from strains whose position still remains to be defined, and had failed to show any specific agglutination. They were finally rejected as not being dysentery bacilli. Boyd, in one of his earlier communications (1932), records the recovery of a number of similar strains from dysentery stools and comes to the same conclusion with regard to their significance.

Five out of the remaining twelve strains, after several subcultures, were found to be eventually lactose fermenters and were also rejected.

There remained seven strains that failed to ferment lactose after twenty-five days' incubation. These also had failed to react with any of the recognized dysentery sera, or with any of the doubtful sera. They were also tested against sera prepared from similar strains isolated previously and also against sera prepared against the particular strains themselves. In one case there was agglutination with the serum of a strain isolated under similar conditions the previous year, but in no other case could any serological relationship be demonstrated.

It was not considered that there was sufficient evidence for regarding these strains, any more than the slow lactose-fermenting group, as causative of bacillary dysentery. Boyd had noted that a third of his slow lactose-fermenting group had been recovered in association with a recognized

dysentery type. This has been the experience of the present writer also in personal isolations. It was thought, therefore, that serial examination of the stools of local dysentery patients might demonstrate more clearly the change that may take place in the intestinal flora during an attack of dysentery.

The investigation has been carried out on thirty-three patients suffering from acute attacks who all came under observation early on in the disease. In twenty-five instances the change was abrupt from plate cultivations showing numbers of colonies of dysentery bacilli with varying numbers of lactose-fermenting colonies to those containing pure growths of lactose fermenters. In eight cases, however, the change was gradual, and the observations have been summarized in the following table.

The serological investigation of these Flexner-like organisms gave results exactly similar to those recorded for the previous group. That is to say they were serologically unrelated to any accepted or suspected dysentery bacillus. The one permanent non-lactose fermenter appeared to be non-antigenic and not only showed no agglutination with any of the above-mentioned sera, but also with those prepared from all varieties of non-lactose fermenting bacteria available.

A composite picture of the changes that may take place would appear to be : Following the infection there is a cellular reaction of varying intensity during which the causative organism is excreted in increasing numbers. The period of excretion is very variable, but when the very acute period is passed the flora may change and organisms simulating dysentery bacilli, yet having no relation to them, begin to appear—at first with the dysentery bacilli and later alone or in conjunction with paracolon bacilli. Finally the intestinal flora returns to normal and only lactose fermenters are seen.

Discussion.

It is a recognized fact that in an attack of bacillary dysentery, the period during which the causative organism may be cultivated from the stool is extremely variable. It is no uncommon experience to find considerable numbers of Flexner-group bacilli in the second or third stool following the commencement of an attack and twenty-four hours later to be unable to detect any such colonies on plate cultivations. On the other hand the specific organism may be excreted in large numbers over long periods.

Very frequently the individual has passed the acute stage before coming under observation, and although the stools may contain blood and mucus it may not be possible to detect the presence of any dysentery organisms. The plate cultivations may, however, show many non-lactose-fermenting colonies that have a superficial resemblance to the Flexner group but fail to react with any of the sera available. These organisms may be very slow lactose fermenters or non-lactose fermenters. In view of the extreme rarity of new serological types since the work of Boyd and others has been

Case	Date in disease of stool	Clinical condition	Condition of stool	Bacteriological findings
H. R. Child	36 hours	Acute	Pus and R.B.C.s only	Sonne R. and S. and coli only
	5th day	Well	Loose, fæculent, no pus or blood	No Sonne, many Flexner-like and lactose fermenters
	12th day	Well	Normal stool	All lactose fermenters
L. Young adult	48 hours	Acute	Liquid stool with some pus and R.B.C.s	Few R. Sonne and lactose fermenters
	8th day	Discomfort only	Loose stool with very few pus cells	Few S. Flexner-like, mainly lactose fermenters
	14th day	Well	Normal stool	All lactose fermenters
D. Adult	48 hours	Acute	Mucus. pus and blood only	Almost pure Boyd type 170
	7th day	Subacute	Some fæces, mostly blood and mucus	Fair numbers type 170 and rest lactose fermenters
	11th day	Considerable discomfort	Fæculent, few pus cells only	Large numbers Flexner-like (S.) few lactose fermenters
	17th day	Well	Normal stool	All lactose fermenters
J. G. Child	24 hours	Acute	Mucus, pus and blood only	Pure growths Sonne (R.)
	3rd day	Discomfort and several stools daily	Fæculent, many pus cells, few R.B.C.s	Very few Sonne (R.), rest Flexner-like (S.), no lactose fermenters
	8th day	Well	Loose stool with few pus cells and R.B.C.s	Equal Flexner-like and lactose fermenters
	17th day	Well	Normal stool	All lactose fermenters
Mrs. W.	24 hours	Acute	Liquid stool with many pus and R.B.C.s	Equal Sonne and lactose fermenters
	48 hours	Acute	Liquid stool with pus cells and R.B.C.s	Many Sonne (nearly all R.), few lactose fermenters
	5th day	Discomfort and loose motions	Loose stool with pus cells only	No Sonne, many Flexner-like and lactose fermenters
	10th day	Well	Normal stool	All lactose fermenters
P. B. Child	24 hours	Acute	Bile-stained mucus, pus and R.B.C.s	Few S. Sonne, many lactose fermenters
	48 hours	Acute	Ditto	Equal Sonne (S. and R.) and lactose fermenters
	7th day	Well	Loose stool, no pus or blood	Very few Sonne (all R.), many Flexner-like (S.); no lactose fermenters
	9th day	Well	Normal stool	Very few Flexner-like, mostly lactose fermenters
	14th day	Well	Normal stool	All lactose fermenters
Mrs. C.	24 hours	Acute	Mucus, pus and blood only	Almost pure growth Boyd type 88
	72 hours	Some discomfort and loose stools	Fæculent, few pus cells	Very few Flexner-like, mostly lactose fermenters
	4th day	Well	Semi-solid stool, no pus or blood cells	All lactose fermenters
S. E. Child	4 hours	Very early acute	Loose, fæculent, few pus cells and R.B.C.s	All lactose fermenters
	48 hours	Acute	Mucus, pus and blood only	Many Sonne (few S., mostly R.) few lactose fermenters
	4th day	Discomfort only	Fæculent with only few pus cells	No Sonne, many Flexner-like, few lactose fermenters
	11th day	Well	Normal stool	Flexner-like, gas-forming paracolon and lactose fermenters
	20th day	Well	Normal stool	Gas-forming paracolon and lactose fermenters
	25th day	Well	Normal stool	Lactose fermenters only

NOTES ON THE TABLE :—

"R" and "S" refer to the "rough" or "smooth" appearance of the colonies.

"Flexner-like" refers to the inagglutinable apparent non-lactose fermenters. With the exception of those recovered from the last case (S. E.) they all eventually did ferment lactose between the twelfth and fifteenth day. S. E. still showed no trace of acid in lactose after three weeks at 37° C.

"Gas-forming paracolon" refers to the large more-opaque colony that produces acid and gas in glucose and mannite in twenty-four hours and frequently ferments lactose after eight to ten days.

fully established it is submitted that these so-called "inagglutinable Flexners," in nearly every case, are not dysentery bacilli at all but "secondary invaders."

The demonstration of the change in flora during an attack of bacillary dysentery is more easily appreciated in Sonne infections than in most other types. As the attack passes its acute stage the Sonne colonies, on plate cultivations, are almost entirely rough, whereas the "secondary invaders" are generally smooth when they first appear. There is little doubt that the recovery of these "secondary invaders" only, as Boyd (1932) suggested, indicates that the causative organism has been missed and that the missing, on occasions, has been due to the concentration on the smooth colony when the true dysentery organism is in the rough phase.

The organisms recovered under the conditions described above do not always simulate the Flexner bacilli; they may be non-mannite fermenters. But such types are found more rarely and generally do not give rise to difficulty.

It will be seen from the table that the observed changes in the intestinal flora are not exclusive to Sonne dysentery. Also the present writer has memories of isolating, many years ago, "inagglutinable Flexners" from Shiga dysenteries. On one occasion the two organisms were present on the same plate, as in the cases mentioned in the table.

Whilst the changes in the flora described above would appear to be associated with the attack of dysentery, organisms of an apparently similar nature to both the non-lactose and the very slow lactose fermenters are cultivated occasionally from the normal stools of healthy individuals and also from the urine of patients suffering from a long-standing cystitis. It is considered that the great majority of such organisms are atypical colon bacilli.

True serological types of the Flexner-Sonne bacteria are isolated from time to time from normal-looking stools of an individual with a vague history of a transient diarrhœa several weeks previously. There is little doubt that such excretors are real "carriers." But whilst it may be expedient for the administrator to include the individuals passing the unclassified non-lactose fermenters, it would appear to be very doubtful if any of them could initiate an attack of dysentery.

Although it is unlikely that no new serological types of dysentery organisms will be encountered in the future, genuine inagglutinable Flexners have been met so rarely in recent years in India that it is considered that their occurrence will be infrequent. Attention has been re-directed to the organisms described in this communication as, in spite of the previous observations of Boyd, it does not appear to be appreciated generally that the significance of the bacterium itself is extremely doubtful, but that its presence in a dysenteric stool, when a true dysentery bacillus has not been demonstrated, is a very strong indication of either failure of technique or that the specimen was passed too late in the disease.

Summary.

Further evidence is brought forward against the acceptance of the great majority of "inagglutinable Flexners" as causative organisms of dysentery.

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NOTES ON WATER SUPPLY, WITH PARTICULAR REFERENCE TO THAT OF ALEXANDRIA, EGYPT.

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General.

A visit to almost any waterworks must, of necessity, be instructive, since it brings under review such a variety of problems connected with the provision of a safe and potable drinking water. It evokes an interest in the quality and potential dangers of the untreated raw water, the various methods and stages of purification, the degree of purity of the fully treated water, and the measures adopted by those in control of the works, and by the public health authorities, to ensure that the water supplied to the public is fit for human consumption at all times.

Nowadays the paramount importance of the provision of a pure drinking water supply has become axiomatic, and far more attention is being paid to this essential public service than in the past. This advance has been due in part to the increasing frequency with which serious epidemics have been traced to contaminated drinking water, and to the inherent dangers that lurk in the acceptance of a water " on trust " because of a long and satisfactory previous record.

It is difficult to define exactly what is inferred by a " safe " water supply, for numerical standards show such large variations in different parts of the world. Apart from the U.S.A., Treasury standards and those at present in preparation by the British Ministry of Health, no officially sponsored standards have yet been established on a legal basis. It would be permissible, of course, to adopt the negative and somewhat non-committal conception that a " safe " water is one which, when consumed regularly in large quantities, proves to be non-injurious to health. Such a water would have to be free from pathogenic or allied organisms and from poisonous metals or organic compounds, and excessive amounts of inorganic salts. In addition, it should be limpid, colourless, odourless, and palatable.

Many raw waters, especially those from deep wells, conform to these criteria at all times, and require no treatment, although samples should be examined chemically and bacteriologically at regular intervals. On the other hand, many large and small cities have to depend for the whole or part of their supplies upon raw water derived from rivers, and, as these are always subject to adventitious pollution, they are consequently potentially dangerous and must be purified. The degree of danger bears a relation to :—

(1) The incidence of endemic disease transmissible by water.

(2) The precautions adopted to prevent river pollution.

(3) The adequacy of the system of purification, and
(4) The laboratory control of the treated water before being pumped into supply.

Irrespective of the results of bacteriological examinations of such river waters, some form of sterilization treatment is imperative since, sooner or later, an infection with pathogenic bacteria is certain to occur which may lead to serious and widespread outbreaks of disease.

In many countries, particularly in the East and Near East, the only sources of water supply are from rivers which, in view of the impossibility of safeguarding them from large-scale sewage pollution, are heavily infected with pathogenic organisms as a result of the high local incidence of epidemic water-borne diseases.

Egypt may be taken as a typical example of such a case, and it is intended in this article to give a summarized account of the means employed for clarification and sterilization, and bacteriological control of the water supply of Alexandria. This city, with its population of nearly three-quarters of a million, depends for its supply of raw water upon the Mahmoudieh Canal, a navigable branch of the River Nile.

This canal passes through the highly cultivated plains of the Nile Delta and is polluted by crude sewage from the towns, villages, and hamlets along its banks. Moreover, it is a commercial highway along which pass endless streams of barges carrying goods to and from the interior. Thus it requires but little imagination to visualize the degree of vegetable and manurial pollution to which it is subjected.

A casual glance at this muddy raw water fills one with misgiving at the thought of having to drink it, although this opinion is considerably mitigated after a visit to the purification works. At the same time, when one contemplates that this water has travelled many thousands of miles from the mountains of Abyssinia, changing the desert through which it passes into fertile plains supporting a population of seventeen millions in Egypt alone, the dominant feeling becomes one of admiration.

No chemical or bacteriological examinations are necessary to confirm the conclusion arrived at from a visual inspection of the source. These examinations are, however, necessary for the purposes of control of subsequent treatment technique, and they show the water to be heavily polluted and dangerous. The quality of the raw water shows great seasonal variations, as can be appreciated from the figures overleaf.

From a perusal of these figures it will be seen that the raw water is very turbid, alkaline, and rich in nitrogenous and carbonaceous organic matter.

The free and saline ammonia is lower than one would expect until it is realized that this water carries during the greater part of the year a fair concentration of algæ. Occasionally there occur, without warning, infestations of algæ, protozoa or crustaceæ, on a serious and alarmingly high scale, when every available means has to be applied to ridding the water of them

TABLE I.—AVERAGES OF DAILY ANALYSES OF WATER FROM MAHMOUDIEH CANAL ENTERING SIOUF WATERWORKS FOR TREATMENT, 1937.

Chemical Results in Parts per 100,000.

	Pre-flood Jan.-July	Flood Aug.-Oct.	Post-Flood Nov.-Dec.	Annual Average
Colour	—	Deep chocolate brown	—	—
Clarity in cubic centimetres	7·9	2·6	5·8	6·2
Turbidity, suspended matter	19·1	57·7	16·7	28·3
Reaction pH	7·88	8·05	7·77	7·91
Chlorides, Cl	4·1	4·2	2·3	3·8
Nitrates	—	Less than 0·001	—	—
Nitrites	—	Less than 0·001	—	—
Free ammonia, NH_3	0·0035	0·0003	0·002	0·0025
Albuminoid ammonia, NH_3	0·028	0·0645	0·0322	0·0377
Oxygen absorbed from $KMnO_4$, 3 hours at 37° C.	0·312	0·560	0·352	0·381
Impurity figure	2·96	6·02	3·38	3·79
Average Bacteriological Results.				
Bacteria capable of growing on agar, 24 hours at 37° C.	4,500 per c.c.	10,300	5,000	6,000
Lactose fermenters (*B. coli*), number per cubic centimetre i.e.	250 + 0·004 c.c.	827 + 0·0012 c.c.	134 + 0·0075 c.c.	378 + 0·0026 c.c.

without causing the production of disagreeable tastes and odours in the town supply.

It is interesting to note the almost complete absence of nitrites and nitrates, both of which one would expect to find in a water receiving sewage. This is due undoubtedly to the absence from the water of any dissolved oxygen capable of fostering the " nitrogen cycle."

Bacteriologically the water shows great variation. Counts of 80,000 per c.c. and positive *B. coli* findings in 0·0001 c.c. being not uncommon during the flood season. Typhoid, paratyphoid, dysentery, diarrhœa, and schistosomiasis are water-borne diseases which are endemic in Egypt, so that anyone, used to a pure water supply, foolhardy enough to drink untreated Nile water risks an almost certain chance of becoming a candidate for hospital with one or more of these diseases.

Total solids in solution are low, the mineral content and hardness being around the region of 20 parts and 10 parts per 100,000 respectively. Solid matter in *suspension*, on the other hand, is extremely high. During the flood season the clarity (depth at which 1 millimetre platinum wire is just visible) is only 2·0 to 2·5 centimetres, the corresponding turbidities rising at times to 200 parts per 100,000. The greater part of this suspended matter is truly " colloidal " and can only be precipitated by the use of electrolytes such as aluminium sulphate.

The most striking feature of water from this source is the degree and rapidity with which its chemical composition and general biological fauna

change. Within the space of an hour, electrical conductivity has been known to increase from 300 to 900 megohms, solids in suspension from 20 to 120 parts per 100,000, bacteria on agar from 2,500 to 12,000 per c.c., and *B. coli* from 10 to 1,000 per c.c. Such drastic variations in quality are of frequent occurrence, and call for unremitting vigilance on the part of the waterworks' treatment personnel.

Method of Purification. Siouf Works.

Purification of this water involves the following considerations :—

(1) Destruction and removal of plankton (algæ, diatomaceæ, crustaceæ, etc.).
(2) Chemical dosing with coagulant.
(3) Clarification.
(4) Filtration.
(5) Sterilization.
(6) Distribution.

(1) Plankton, in general, is removed by two self-cleansing rotating screens placed in series, of 18 and 50 meshes to the inch, and by use of combinations of the usual algicides. These screens are very effective and also remove large amounts of inert suspended matter.

(2) *Chemical Dosing and Conditioning.*—After passing through the screens the water flows through two shallow cement-lined canals, each about 1,000 metres long, which provide a small reserve of raw water and permit of treatment, whenever necessary, with algicides, prechlorination, or primary coagulation with potassium permanganate.

At the far end of the canals the algæ-free water receives its appropriate dose of coagulant before being pumped into the conditioners and clarifiers, wherein the suspended matter is deposited.

The question of clarification presents a difficult problem for, as has been noted already, the greater part of the suspended matter is present in a finely divided colloidal condition. Colloids resist ordinary gravitational sedimentation, even with prolonged standing. Consequently, resort to flocculation by chemical means becomes essential, aluminium sulphate being employed in this instance.

The dosing gear for this substance is automatically controlled for variations in pumping rates and, in the near future, it is intended that the dose itself shall be varied automatically with the chemical requirements of the raw water, by means of transmission gear operating through a recording pH meter.

The amount of coagulant employed varies between 8 and 100 parts per million (0·56 and 7·0 grains per gallon) in accordance with the pH and turbidity of the raw water.

Aluminium sulphate, when mixed with a slightly alkaline water such

as that of the Nile, decomposes to form an insoluble gelatinous precipitate of aluminium hydroxide, on which the microscopic flocculi of suspended matter are occluded. In practice, a few seconds after having received its dose of coagulant, the water is pumped into chambers known as "conditioners," fitted with specially designed revolving paddles. It is in these that the silt-laden alumina flocculi are agglomerated into dense, well-formed particles, in a fit state for rapid settlement when the water is discharged, thirty minutes later, into the adjoining clarifiers.

(3) *Clarification.*—This is the most vital step in the process of purification of water containing colloidal silt, for on its success or failure depends not only the ease of sterilizing the effluents from the filters, but also those qualities which render the final supply water æsthetically satisfying to the general public. The employment of a clarifier which allows the formation of stagnant "pockets" of water, or of irregularities in water circulation, can give rise to troubles which will exert a detrimental influence on the biological "freshness" of the filter sand and the limpidity of the filter effluents, both of which factors operate against the successful application of the final process of chlorination.

Clarification and clarifier design have been the subjects of much experimental work at Alexandria on laboratory and model scale during the past ten years. Some of the problems investigated and elucidated were :—

(i) The most suitable coagulant and the best method of adding and mixing it so as to form the densest and least buoyant type of flocculi.

(ii) The most efficient type of clarifier to (*a*) Control movement of water during clarification and render impossible the formation of stagnant patches of water ; (*b*) damp out disturbing temperature effects which, in tropical climates, exert a vitiating influence on the efficiency of most clarifiers ; (*c*) respond immediately, and without disturbance of previously settled sludge, to changes in rates of flow.

(iii) The most suitable method of introducing the influent water and withdrawing the effluent.

(iv) The behaviour of water whilst circulating through the sedimentation basin.

(v) The best means for automatic sludge removal.

As a result of this extended programme of experimental work, a new type of circular clarifier was eventually designed in the form of a 15-foot model. Later two 110-feet prototypes were installed at the Siouf Works, each holding one million gallons and capable of clarifying five and a half million gallons per day. They have been in continuous use for three and a half years, and have proved to be eminently suitable for dealing with this

type of water under all conditions. Throughout their period of operation the average suspended matter removal from the raw water has been 93·2 per cent, and reduction of the albuminoid ammonia and oxygen absorbed by 70 per cent and 69 per cent respectively—a very satisfactory result. The average clarity of the effluent has been 60 centimetres.

Amongst the advantages of this design should be mentioned :—

(i) An effluent of such high clarity as to render unnecessary the use of secondary sedimentation tanks.
(ii) High " capacity " efficiency—retention time only four hours, compared with the usual seven or eight hours.
(iii) Economy in coagulant consumption.
(iv) Immediate compensatory response to changes in temperature or rates of flow of the influent.
(v) Simple form of automatic desludging.

(4) *Filtration.*—The effluents from the clarifiers are collected into a common main and flow by gravity to four rectangular rapid sand filters (Jewell design), each filter having an area of 125 square metres and being designed to work at a maximum rate of 100 cubic metres per square metre per day (Egyptian statutory rate). The system of cleaning is by " air scour " followed by high pressure upward water wash. Filters are always washed once every forty-eight hours, or more frequently if required.

The effect of filtration is to produce a clear bright water containing less than 0·1 part per 100,000 solid matter in suspension (i.e. a clarity in excess of 200 cm.), and the bacterial count of the effluent from the clarifiers is reduced by 90 per cent or more.

(5) *Sterilization.*—The filter effluents are now collected into a central channel where ammonium sulphate (0·3 to 0·6 part per million) is added. The water passes over a " hydraulic jump " to ensure thorough mixing and then flows out of the main filter building into a small covered " turbulence " reservoir, where chlorine is added to complete the second stage of the chloramine process.

The dose of chlorine employed varies between 0·3 and 0·6 part per million, and is dependent upon the amount of residual chlorine found to be present in water which has had two or three hours' contact in the Works' storage reservoirs. The quantity of chlorine used is so regulated that the free chlorine will vary between 0·05 and 0·1 part per million at the outlet of the reservoirs. This procedure is found to produce a sterile drinking water and preserves the distribution mains throughout the city in a healthy sterile condition.

In this particular works there are three storage reservoirs, each containing one and a half million gallons, through which the chlorinated water circulates before being pumped into supply. The reservoirs are constructed in such a manner that the risk of atmospheric contamination

is eliminated. Each reservoir is fitted with a small ½-inch pump over the outlet valve which operates continuously for the purpose of taking samples for bacteriological examination. Samples are taken every two hours throughout the day and night for chlorine estimation.

The works has its own laboratory and a competent staff of European chemists. Great trouble is taken to ensure that the plant always works at maximum efficiency, and the records for the fully treated supply water confirm the effectiveness of the control methods employed. Mention should be made of the fact that the quality of the water distributed through the town mains is also controlled by the Alexandria Municipality, independently of the Water Company staff. Samples are taken by the Municipality daily from public clinics, police stations, etc., in all quarters of the town and in the following table their bacteriological results are given as well as those obtained in the Water Company laboratories.

TABLE II.—BACTERIOLOGICAL RESULTS OF EXAMINATIONS OF SAMPLES TAKEN AT VARIOUS POINTS IN THE TOWN AND SUBURBS OF ALEXANDRIA DURING THE YEARS 1934-1938.

Year	A. W. Co. Laboratories			Municipal Laboratories		
	No. of samples	Bacilli on agar per c.c.	No. of samples showing complete absence of *B. coli* in 100 c.c.	No. of samples	Bacilli on agar per c.c.	No. of samples showing complete absence of *B. coli* in 100 c.c.
1934	2,437	9	100·0 per cent.	1,401	26	99·3 per cent.
1935	3,440	7	99·4 ,, ,,	1,381	26	100·0 ,, ,,
1936	4,093	10	99·9 ,, ,,	1,971	25	99·9 ,, ,,
1937	4,332	11	99·9 ,, ,,	2,073	29	100·0 ,, ,,
1938	4,185	13	100·0 ,, ,,	2,079	26	100·0 ,, ,,
Total or average	18,487	10	98·8 ,, ,,	8,905	26	99·8 ,, ,,

TABLE III.—ANNUAL AVERAGES OF DAILY CHEMICAL EXAMINATIONS OF FULLY TREATED WATER.

Colour	Less than 10 A.P.H.A. units
Taste and odour	Nil
Temperature	22·7° C.
Reaction	pH = 7·30
Electrical conductivity at 20° C.	342
Solids in solution	19·8 parts per 100,000
Chlorides, Cl	3·8 parts per 100,000
Free chlorine (chloramine)	0·12 part per million
Nitrates	Less than 0·01 part per 100,000
Nitrites	Nil
Iron	Less than 0·01 part per 100,000
Residual aluminium	0·013 part per 100,000
Total hardness	10·5 parts per 100,000
Temporary hardness	4·3 ,, ,, ,,
Permanent hardness	6·2 ,, ,, ,,
Free ammonia, NH_3	0·007 part per 100,000
Albuminoid ammonia, NH_3	0·0057 ,, ,, ,,
Oxygen absorbed, $KMnO_4$, 3 hours, 37° C. ..	0·0605 ,, ,, ,,

Conclusion.

A high-grade water supply showing an absence of *B. coli* in 100 c.c. in practically 100 per cent samples.

Summary.

(1) A brief description of the source, quality, method of purification and bacteriological control of the Alexandria water supply is recorded.

(2) Mention is made of a new type of clarifier which is proving highly efficient.

(3) The system of bacteriological control is rigid. Unremitting care and vigilance are exercised by those in control of the water works and by the Public Health Authorities to ensure that the water supplied to the public is at all times fit for human consumption.

7TH SESSION DE L'OFFICE INTERNATIONAL DE DOCUMENTATION DE MÉDECINE MILITAIRE.

THIS session was held at Bucarest immediately after the close of the IXth International Congress of Military Medicine and Pharmacy.

Several very important papers were read at the meeting, and amongst them was one on "A Proposal for the Creation of Hospital Zones in War," by Colonel P. Jinga, Chief of the Medical Staff of the Roumanian Army. This paper excited considerable interest and we reprint it from the records just received from Colonel Voucken, Liége.

Later on we hope to print notices of other papers read at the meeting.

A PROPOSAL FOR THE CREATION OF HOSPITAL ZONES IN WAR.

BY COLONEL P. JINGA,

Chief of Medical Staff, Roumanian Army.

I.—HISTORICAL.

THE International Committee of the Red Cross (I.C.R.C.) addressed its Circular No. 336 to the Central Committee of the National Red Cross Societies of the various countries with regard to the creation of hospital towns and areas. This proposal was to be put before the appropriate Ministers in order to ascertain the opinions of general staffs, and to nominate a representative to a military commission which would meet later.

The idea of hospital towns and areas dates from the Franco-Prussian War of 1870; no voice has ever been raised against so purely humanitarian an idea, but it has nevertheless remained entirely undeveloped. The fact is that the proposal discloses on examination many purely military problems.

Many attempts have been made to formulate a number of general principles to serve as a basis of construction, separating the humanitarian from the military aspect and leaving the study of the more technical points to military experts.

The I.C.R.C., charged with the problem by Resolution XXXVII of the I.R.C. Conference of Tokio (1934), and in reply to the proposition of the Permanent Committee of the International Congresses of Military Medicine and Pharmacy (I.C.M.M.P.), decided to call a conference of experts at Geneva on October 15, 1936. This Conference brought together representatives of several National Red Cross Societies and delegates to the Medico-legal Commission of the I.C.M.M.P., the League of Red Cross Societies, and the International Union for Child Welfare.

The Conference, though unanimously of the opinion that the creation of hospital towns and areas was most desirable, confined itself to formulating general principles for a Convention relating to hospital towns, leaving to military experts the ulterior study of technical considerations.

In order to simplify the future task of the military experts, the I.C.R.C. summarized the decisions in twelve Articles to serve as the framework of a

Convention, but acknowledged that their substance is still incomplete and must be reviewed.

At this evolutionary stage the time has come for the question to be studied by military medical services, after which it will be put into its final form by the general staffs and lastly signed by the appropriate Ministers of Governments.

II.—Principles Propounded by the Roumanian Army Medical Staff.

This proposition is animated by uncomplicated realism and founded on the following principles :—

(*a*) Complete separation of the humanitarian idea from the military question of application. We believe that this will result in a greater number of countries agreeing to participate.

(*b*) Settlement of the number of hospital zones in proportion to the population of the country concerned. Settlement of the extent of the hospital zones, to consist of towns or areas, as desired.

(*c*) Secrecy with regard to the names of the hospital zones, maintained until the outbreak of hostilities. A certain number of zones to be nominated by competent authorities to an approved body (I.C.R.C.), which will select some of them but will observe secrecy with regard to those not used.

(*d*) Full power to be accorded to the President of the I.C.R.C., sitting with a staff of neutral officers, to select zones within the approved proportions and to distribute the neutral Commission of Control (C.C.) according to a list approved by the various Governments. The date on which the hospital zones of two or more belligerents will come into operation will be regulated by the I.C.R.C., which will appoint one date for all or by groups proportionately arranged.

(*e*) No preparation of hospital zones of any sort to be made in time of peace. This should be adhered to because, the sole object being the protection of sick and wounded, foreknowledge of locality would allow privileged persons to acquire land or property with a view to their ultimate personal protection or financial gain.

(*f*) Plenary powers for the neutral C.C. in the zone in applying the Regulations, with special regard to the strict maintenance of the population of the zone, allowing no increase from without ; and the strict maintenance of material neutrality in the sense of restricting all activity of these zones to the special needs of the medical services to the total exclusion of military uses or those calculated to facilitate the conduct of warlike operations.

(*g*) Permanent neutrality of hospital zones in all situations of warfare throughout the whole duration of hostilities. No marks of identification (signalization), since all flying and staff maps will show the boundaries of the zones.

(*h*) Completion in time of peace of operational Regulations for the neutral C.C. by the I.C.R.C. and the permanent committee of the I.C.M.M.P.

The high signification and importance of the idea will be fully appreciated, but great ideas of this sort, to be practicable, must be free from all complications and based on sincerity and confidence. I place my modest proposal before the distinguished military representatives of medical science who honour this meeting with their presence. Starting with its three cardinal features—simplicity, sincerity and confidence—I think that it should be possible to show that man is capable of applying that splendid sentiment, Humanity.

Draft Articles to Serve as a Basis for a Convention Relative to the Creation of Hospital Towns and Areas.

(The same number of articles as in the Draft referred to in Circular 336 of the I.C.R C.)

An Agreement to Create Hospital Zones.

Designation and Notification of Hospital Zones.

Art. 1.—The Contracting Parties undertake to recognize the obvious necessity of creating protected hospital zones (including areas or towns) for the sole purpose of sheltering the sick and wounded in war in the proportion of one zone (areas or towns) per two million inhabitants.

(The estimate shall be in millions, a fraction counting as the round number. To the total of an uneven number of millions, one million to be added to keep the number of zones integral.) The maximum extent of a zone (areas or towns) shall be ten square kilometres. The zone shall be, as far as possible, clearly visible and bounded by rivers or other natural features. It is desirable that it should possess its own source of potable water.

Zones proposed in countries, colonies or dominions, shall correspond with the population of those countries, colonies, or dominions.

Art. 2.—During times of peace each Contracting Party shall have the right of proposing a general list of zones of the extent hereinbefore indicated. This list shall be deposited with the I.C.R.C. under sealed cover with all precautions necessary for secrecy. The documents envisaging armed conflict arising from no matter what direction shall include a triple number of zones, the depositor having full liberty to select the best way of keeping his secret and of identifying and describing them.

Art. 3.—The choice of hospital zones is reserved to the President of the I.C.R.C., sitting with two or four neutral staff officers. Choice shall be made by a majority vote. The operation of choosing shall take place at Geneva on the outbreak of hostilities, and the zones chosen shall be subject to acceptance by the belligerents with no more than slight delay. Objection shall take effect only in favour of the Contracting Party raising it, and must be dealt with in not more than fifteen days.

Art. 4.—The final list shall be notified to the belligerents by the I.C.R.C. with all possible urgency.

Conditions of Use of Hospital Towns and Areas.

Art. 5.—Once put into operation, hospital towns and zones shall be reserved solely for the needs of medical services to the exclusion of all

military purposes or those which are such as to facilitate the conduct of war-like operations. The cases provided for in Article 8 of the Geneva Convention are not hereby excluded.

ART. 6.—The protection due to hospital zones shall cease if they are used for purposes harmful to the enemy. Such purposes shall be defined in advance by an International Commission of Inquiry (I.C.I.), which shall complete the inquiry begun by the C.C.

ART. 7.—Any zone threatened with inclusion within the area of combat shall not be evacuated, the belligerents taking all measures for its protection.

ART. 8.—In the event of capture by the enemy, the hospital may continue to be used as such by the occupier under the same C.C. and receiving the sick and wounded of both sides who become casualties in its proximity, up to the limit of its capacity. The occupier shall guarantee the provisions of the Geneva Convention to persons entitled thereto. The civil population shall be under the general rules of international law.

Control of Hospital Zones.

ART. 9.—Hospital zones shall be compulsorily placed under the control of a C.C. composed of persons under neutral jurisdiction nominated by the I.C.R.C. and accepted by the belligerent concerned. The list of Presidents of the Commissions and their personnel shall be drawn up provisionally in time of peace. No hospital zone shall function except in the presence of at least one member of the C.C. The commencement of operation of the zones shall be regulated equitably by the I.C.R.C.

ART. 10.—Belligerents shall do all in their power to facilitate the work of the C.C., which shall be governed by Regulations. These Regulations shall be drafted by the I.C.R.C. and submitted for the approval of the various Contracting Parties. The Regulations shall have a common form, or forms, applying to two or more States accepting the same meaning of the constituent Articles. It is highly desirable that these Regulations shall be drawn up without delay. The C.C. shall include at least one member of the I.C.I., appointed in time of peace with the same formality. The personnel of the C.C. and the member of the I.C.I. shall be remunerated by the municipalities within the hospital zones and shall be accommodated with free quarters.

Application and Execution of the Convention.

ART. 11.—An I.C.I., composed of neutral persons accepted by the Contracting Parties, shall be constituted in time of peace. On the demand of a belligerent, or of the C.C. of a hospital zone, this Commission shall open an inquiry into any alleged violation of the Convention. On confirmation of the violation, belligerents shall terminate it and proceed against the offenders as promptly as possible. The I.C.I. shall take note of the inquiry begun by the C.C. and its original representative.

ART. 12.—The dispositions of the Convention and of the Regulations to be prepared shall be respected in all circumstances by Contracting Parties.

Editorial.

REPORT ON THE HEALTH OF THE ARMY FOR THE YEAR 1937.

THE health of the troops for the year 1937 was most satisfactory. Compared with the previous lowest record for the post-war period in 1935, when the admission-rate was 392·1 per 1,000, the admission-rate for 1937 was 413·6 per 1,000 and practically equal to the ratio 413·3 per 1,000 for the quinquennial period 1932-36. The ratio of 1·97 per 1,000 for deaths and the ratio 6·8 per 1,000 for invalids finally discharged from the Service are the lowest recorded since the Great War.

The principal causes of admission to hospital were: Venereal diseases, influenza, inflammation of areolar tissue, malaria and inflammation of tonsils. There was an increase in the admission ratio of influenza and gonorrhœa and a decrease in malaria, diseases of areolar tissue and inflammation of tonsils.

Judged by the average sick time to each soldier the commands with the highest ratio of inefficiency were China, Ceylon, Aden, Jamaica and Burma. Those with the lowest ratio were Malta, Gibraltar, Bermuda and Palestine.

The principal causes of invaliding were: Tuberculosis, schizophrenia, hysteria, inflammation of the middle ear and valvular disease and disordered action of the heart. The average number constantly in hospital was 22·33 per 1,000 of strength compared with 23·21 per 1,000 in 1936. The average sick time to each soldier was 8·15 days compared with 8·5 in 1936. The ratio per 1,000 of strength treated as out-patients was 1,164·1 with an average daily number under treatment of 17·66 per 1,000.

Chart II is of particular interest at the present time as it indicates the high proportion of invaliding from circulatory and nervous diseases from 1899 to 1906 and from 1914 to 1926, the periods of the South African War and the Great War. Chart III shows similar rises from all causes for the same periods. The importance of the neurologist and cardiologist in the treatment of nervous and heart cases was realized somewhat late in the Great War, but with modern teaching there should be no lack of officers suitably trained for the present emergency.

The effects of common ailments on military efficiency in Commands at home are given in Table III, and the corresponding effects in Commands abroad in Table IV. At home local injuries caused a loss of 83,527 working days, diseases of the digestive system a loss of 48,257 days, venereal diseases 62,050 days, and influenza 42,854. Abroad venereal

diseases caused a loss of 117,023 working days, local injuries 33,821, and diseases of the digestive system 29,769 days.

The ratio per 1,000 of admissions for malaria in 1937 was 17·1 compared with 23·3 for 1936. In India the malaria incidence was the lowest yet recorded for British troops, being nearly one-third less than in 1933. The low incidence was undoubtedly due to favourable weather conditions helped by the systematic and careful anti-malaria work carried out annually in stations. The ratio for relapses was half that of 1933, probably due to plasmoquine now invariably combined with quinine or given after the course of atebrin treatment.

The combination of atebrin and plasmoquine is favoured in military hospitals owing to the shorter course of the treatment. This treatment is supplemented in some cases by quinine alone for the first forty-eight hours, with a view to the more rapid reduction in temperature which occurs when quinine is given.

In field units in the Waziristan operations atebrin musonate injections were extensively used as a preliminary treatment. Cases so treated arrived at the base hospitals in better condition than those treated with quinine or atebrin by the mouth.

Experiments with the synthetic preparation certuna have been carried out in military hospitals. Certuna has no antirelapse factor such as is the case with plasmoquine. The effect on *Plasmodium vivax* gametocytes is slight, probably less than that of atebrin, but it definitely prevents the development of gametocytes of *Pl. falciparum.* It is thought that in view of its non-toxicity this drug might be issued to populations where *Pl. falciparum* is the predominant strain.

In view of the adverse reports on paraffin citronella oil and the difficulty of its carriage by the soldier, a new anti-mosquito cream consisting of citronella oil, camphor, cedarwood oil and hard paraffin, has been issued to the troops in 1-oz. aluminium screw-top containers. The reports so far received show that the cream is a great improvement on any previous culicifage preparation ; it is also effective against sand-flies.

An extensive trial has been made with the so-called " B " pattern bivouac mosquito net for use in either 160-pound or 80-pound tents, for which the ordinary peace-time net is not suitable. The results are stated to have been excellent.

In China there was an unduly high relapse-rate due either to very heavy infections or to reinfections of susceptible persons who have continued to live in malarious places. Probably also to the use of atebrin alone, not followed by plasmoquine, in the treatment of malaria during 1936.

In India the incidence of enteric fevers for British troops was only 0·5 per 1,000, compared with 1·3 in 1935 ; for Indian troops it was 0·3. There was a marked reduction in paratyphoid A ; this was only 0·04 per 1,000, compared with 0·2 in 1935.

For the first time no cases occurred among British troops with under one year's service in India; over one year in India the cases were 0·15 per 1,000 and the case mortality 50 per cent. Inquiry into the period after inoculation at which infection occurred, showed that while the incidence among the enteric group of fevers remained much the same in the six-monthly periods after inoculation, among the definite typhoid cases there has been an increase in the percentage occurring in the twelve to eighteen months period. While retaining the 0·5 and 1 c.c. dose of T.A.B. at ten days' interval for primary inoculation, it has been decided to reinoculate at the end of the first twelve months with 0·5 c.c., and continue with this dose at twelve-monthly intervals during service in India.

In India the admissions for the typhus group of fevers were less among British troops, 0·6 per 1,000 compared with 0·8 per 1,000 in 1936. The cases fell into two main serological groups, *Proteus* OXK and *Proteus* OX19, and a smaller number *Proteus* OX2. The symptoms were more severe among Indian patients; the complications were venous thrombosis, lobular and lobar pneumonia.

In only two cases was there any history of insect bites sufficient to impress the fact on the patients, and in none was there any history of tick bites. That *Trombicula deliensis* may be largely concerned was discovered by an R.A.M.C. officer who, while on a shooting expedition in the Simla Hills area, was bitten severely on the legs by some small insect. On examination at the Central Research Institute, Kasauli, the stockings he had worn were found to contain numerous *Trombiculæ deliensis*. Twenty-eight days later, in Poona, he developed a severe attack of scrub typhus—seventeen days pyrexia and titre of agglutination to *Proteus* OXK of 1 : 20,000. The majority of the scrub typhus cases occur annually among British troops in hill areas during the autumn months.

Anamnestic reactions in T.A.B. "H" agglutinins were prominent in all three groups, and a few years ago the cases would have been included in the enteric group of fevers.

The total admission rate for dysentery at home and abroad was 8·5 per 1,000 of strength, compared with 9·8 in 1936. The greatest number of admissions occurred in India due to the insanitary conditions of bazaar areas near troop lines. In Quetta bacteriological examinations of mucus from bazaar and servants' latrines were carried out, and dysentery bacilli were isolated from many of the specimens. The location of cases corresponded to the situation of the infected latrines, and the number of cases to the prevalence of flies.

Bacillary dysentery has remained at a constantly high figure, about 24 to 25 per 1,000, while the figures for amœbic hepatitis and liver abscess are only one-third of those for 1933. This seems to indicate that the fly

cannot be a major vector in the spread of amœbic dysentery, as is usually supposed.

In Egypt fractional test-meals were carried out in a small series of patients suffering from dysentery, and it was found that a condition, achlorhydria, was associated with a more severe form of the disease; in the remainder, whose acidity curves were high or within normal limits, the dysentery was much less severe. The gastric acidity of 100 soldiers serving in Egypt has been shown to be lower than that of 100 medical students, as published by Bennett and Ryle.

In 1937 there was a slight increase in the incidence and the number of deaths from pulmonary tuberculosis. Certain features are more or less constant. There is an increased incidence from 25 years of age onwards, and the greatest incidence after ten years of service. The Foot Guards show the highest incidence, 2·9 per 1,000, then the R.A.S.C. and the R.A.M.C., 2·4 and 2·3 respectively; Household Cavalry have an incidence of 1·2 per 1,000, and the Infantry 0·9 per 1,000.

There is a very great incidence of tuberculosis in the garrison of Malaya. It is thought that the moist heat of the climate exerts a definite influence in activating any latent form of tuberculous infection in the pulmonary system.

There has been a rise in the incidence of venereal diseases of 3·5 per 1,000 of strength—gonorrhœa caused an incidence of 22·2 compared with 18 in 1932–36. Treatment with gonococcal vaccines has been abandoned, and sulphanilamide and M & B 693 used with great success. The period in hospital has been reduced by one-third, and the whole atmosphere of the gonorrhœa wards has changed for the better.

Special events affecting the health of the troops were the operations in Palestine and in Waziristan, and the outbreak of cholera in China.

In Palestine, although certain parts are notoriously malarious, the health of the troops was remarkably good and malaria well controlled.

In Waziristan the health of the troops was amazingly good. In a country notorious for malaria and sandfly fever and for the rigours of its climate, the sick rates were only slightly in excess of normal peace rates, viz. 3·09 per 1,000 per day for British troops, and 1·71 per 1,000 per day for Indian troops.

In the China Command the Japanese invasion seriously affected stations occupied by British troops. In Shanghai conditions were at their worst, but in spite of this the general health of the troops was maintained in a satisfactory state. The cholera epidemic affected a considerable part of China. In Hong Kong the peak was reached in August with 440 cases, and in Shanghai in September with 726 cases in the week. In Hong Kong there were no military cases, and in Shanghai only five military cases caused by the consumption of ice-cream from an unauthorized source.

The increasing use in training camps of piped water supplies has led to difficulty in disposing of the increased amount of sullage water. By using ferrous sulphate and lime, as suggested by Hattersley, it is possible to separate sludge and water; the sludge can then be dried and the water disposed by soakage.

A new pattern sun helmet has been issued to several tropical stations. The pugaree has been discarded and its place taken by an ornamental band. There is a marked improvement in ventilation and an insulating lining of aluminium foil is fitted as an inner casing for the dome.

The provision of pyjamas for all soldiers has been advocated for some time, but no decision as to such a supply has yet been made. The provision has been urged repeatedly in hygiene reports from commands at home and abroad.

There has been an increase in the scale of rations and ration allowances have been introduced. These increases allow the soldier to be provided with a daily supper meal.

In India, Government military dairies now provide milk for all British troops and for a good proportion of Indian troops.

A remarkable achievement in the Waziristan operations was the daily supply of fresh milk to all areas, including the most forward posts. Right through the heat of summer, with temperatures up to 122° F., fresh milk in special iced containers and fresh butter were delivered at supply points, even to places cut off by enemy action from ordinary military traffic.

Clinical and other Notes.

BOOT CLIP FOR EXTENSION OF LEG IN THOMAS LEG SPLINT.

By Lieutenant-Colonel D. C. MONRO,
Royal Army Medical Corps.

When using the Thomas leg splint in first-aid work it is necessary that the injured limb should be steadied in the splint by a combination of fixation and extension. A certain degree of fixation can always be obtained by simple padding and bandaging, but it is fully realized that sufficient extension is the key to the value of this splint.

The advantages of any method of applying this extension, quickly and easily, are obvious.

Under certain circumstances, extension cannot be applied as first aid, but must wait till the case reaches a M.D.S. or C.C.S. For example, when, in addition to a compound fracture of the thigh or leg, the foot or ankle is

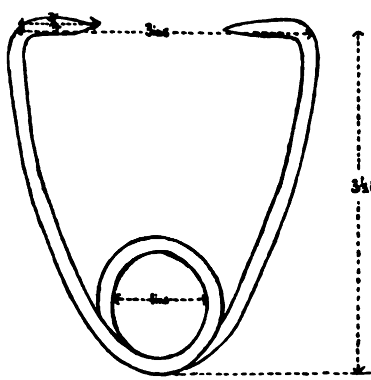

Fig. 1.—The Picton Clip.

damaged, or where contamination of the boot by mustard gas necessitates its early removal for the urgent treatment of the local skin.

On the other hand, in all cases where the boot may be left on the foot, one of the two methods described in the R.A.M.C. Training Manual (para. 627 *et seq.*) or First-Aid Manuals, is available. In the first method a skewer is made to pierce the waist of the boot, slightly obliquely, just in front of the heel. The skewer passes between the sole of the foot and sole of the boot. Although this skewer has a sharp or gimlet point, it often requires considerable force to insert and may well produce painful rotation movements at the fracture. In the second method, a simple clove hitch of bandage applied over the boot takes the extension strain. In both these methods, and in the modification to be described, the extending force is exerted indirectly to the limb, through the boot. Provided the boot is a normal fit and properly laced,

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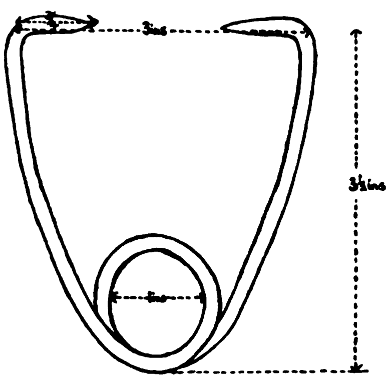

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the strain, which is merely a temporary steadying one, will cause no serious pain or pressure damage to the dorsum of the foot.

In a recent number of the *British Medical Journal* Dr. Lionel J. Picton

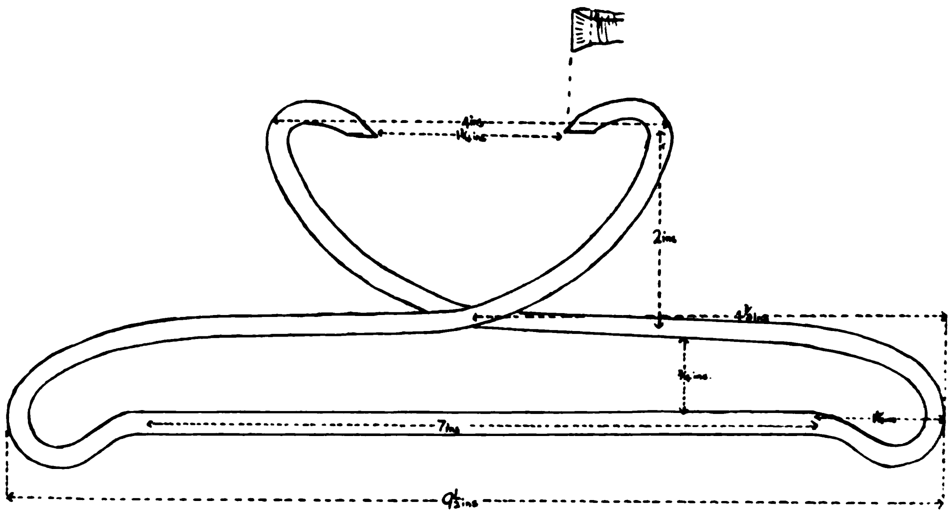

FIG. 2.—The Millbank Clip. Spring steel, ¼ in. diameter, or mild steel.

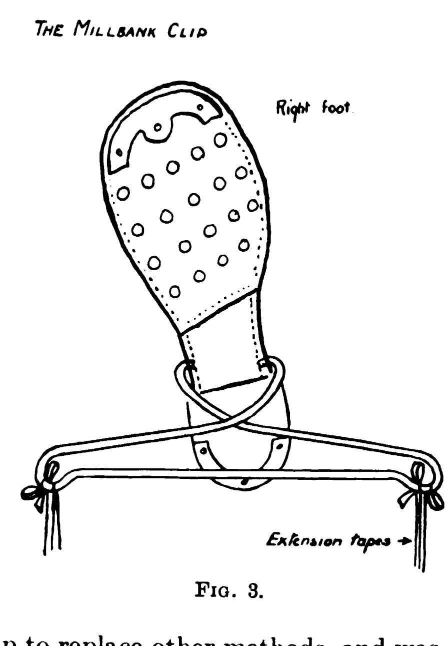

FIG. 3.

described a boot clip to replace other methods, and was kind enough to send one of his pattern to Millbank. His clip is simple and can be quickly slipped on to the boot. It has the advantage that it requires no force to apply, and does no damage whatever to the boot. On the other hand, it

does not prevent rotation movements of the leg. With the object of eliminating this defect, the modification, here illustrated, was devised. It will be seen that the spring is obtained in a similar manner by using mild steel; but the lateral extensions of the clip rest firmly on the bars of the splint, and in so doing hold the foot dorsiflexed and comfortably steady, *without* the addition of a foot piece.

The Millbank Clip is made of one piece of metal, has sufficient spring to permit the jaws opening to grip the sole, and when the extension tape is applied to the lateral arms the bite is secured in proportion to the extending force, and the boot upper remains undamaged.

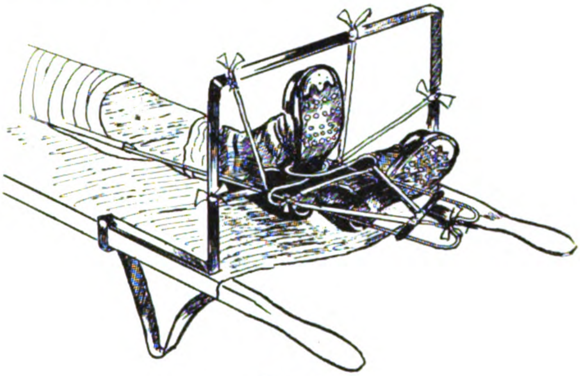

Fig. 4.

It is hardly necessary to insist that all credit for the inception of this type of clip belongs to Dr. Picton.

I am indebted to the Commandant of the Royal Army Medical College for permission to send this note for publication. I also wish to thank Colonel J. M. Weddell, F.R.C.S., K.H.S. (late Consulting Surgeon to the Army), Mr. Reed, and Staff-Sergeant Farrimond of the Surgical Department, for much valuable assistance and advice, and Mr. Leach for the excellent illustrations.

DUODENAL ULCER: A PLEA FOR A MORE RATIONAL SCHEME OF TREATMENT.

By Major G. F. Harrison,
Royal Army Medical Corps.

This short article does not describe some new and startling remedy which will banish duodenal ulcer in a night, rather is it a series of observations which *Punch* might describe as "Glimpses of the Obvious," yet which appear to require emphasis however obvious they may seem to some. The treatment of duodenal ulcer appears, in some quarters, to be so encumbered with ritual that the rationale of the treatment has become obscured.

Information collected from patients themselves and from their medical

documents, shows that in many cases treatment has been of the following nature: They had been put to bed and placed on a "No. 1 Diet" consisting chiefly of milk, Benger's food, custard and fruit jelly, and in addition. antacid powders. Later they had graduated to a "No. 2 Diet," which had a few minor additions. Finally, after weeks in hospital, they arrived at a diet excellent in many ways for anyone who could stay permanently in hospital but totally different from anything which the soldier-patient could hope to procure in barracks. The treatment had ended with the gift of a long printed list of articles of food which they were to avoid, and then they were discharged to the unsympathetic outer world to fend for themselves. Delighted at their release from hospital, and free from symptoms, most of these patients had quickly lost the printed list of "Don'ts," and had quite forgotten what it was they were supposed to avoid, and many of them sooner or later were back in hospital with the same complaint. One recent case did "remember" quite clearly that he was allowed white meat but not red, but was quite surprised to learn that there was anything wrong in having a hurried breakfast at 7.30 a.m. and lunch at 1.30 p.m. with no food in the interval, a custom of his for many years.

Treatment should, but frequently does not, take into consideration the patient himself, and this is especially important in this condition. If it is agreed that habits, customs and mental state are important factors in the causation, they must be taken into account in the treatment. These patients should be taught to know themselves, and by this self-knowledge assist themselves to recover. And yet how rare it is to meet an ulcer patient who has any insight into his condition. This lack of insight is well known to be present in those suffering from their first attack, but it should not exist once they have come under medical supervision.

The type of man who suffers from this condition is well recognized. His long, thin face, sharp nose, spare features, and absence of spare fat, have often been described. The air of "aggressive alertness" and other features have been well portrayed by Davies and Wilson (1937) in their excellent review of the life history of a peptic ulcer. These authors found that in no less than 84 per cent of their series of patients, disturbing events concerning work (30 per cent), finances (32 per cent), and illness or family misfortunes (22 per cent), had immediately preceded the onset of dyspepsia which had ended in peptic ulcer. McGregor (1938) too, commenting on the fact that peptic ulcer is usually treated as a purely digestive disease with diet, alkalis, rest, etc., states that the emotional factor in the causation of duodenal ulcer receives less attention in the treatment than it deserves.

The same type is found in the Army as in civil life. His job, more often than not, is either that of a busy clerk in a responsible position, working long hours in an office, smoking innumerable cigarettes and getting his meals at long and irregular intervals; or he is an over-conscientious N.C.O.; or he is a driver of a motor lorry, a job entailing prolonged and strained attention and often leading to that underlying feeling of anxiety which is so

often present in these patients. In nearly all of them a tendency to be over-conscientious or a tendency to worry unduly, has been a feature of their personalities.

It is suggested that the valuable time which the patient spends in hospital should be used to introduce him to new ways of thinking and to train him to those new habits which, it must be emphasized to him over and over again, must serve him for the rest of his life ; a time in which he can contemplate the error of his previous ways. He should be told that the treatment in hospital is merely in the nature of a preliminary training, hospital and post-hospital treatment being continuous. A simple explanation of the nature of his condition and the treatment, emphasizing the necessity of neutralizing the acid in his stomach with alternatively food and powder every two hours, the part which worry and smoking plays, is of more practical use than all the printed lists in existence. Assuming he will have four main meals a day after he has left hospital, it is necessary for him to take extra food, say biscuits or chocolate, only three times, and powder, preferably neutral in reaction, only three times a day for the acid in the stomach to have something to act upon every two hours over a fourteen-hour period. It may be argued that the average soldier does not get the opportunity to take such extra food and powders, but this argument does not hold as these patients are not average. Their jobs, more often than not, are of the type already mentioned and essentially do allow them this opportunity. It is perfectly possible to carry three small packets of powder in a pocket, yet even this simple device has sometimes to be explained as some patients plaintively ask how they can " carry bottles of powder about."

The importance of the two-hourly régime is obvious to anyone who has seen the crop of recurrences which is apt to occur in a big command, such as Aldershot, after annual manœuvres when meals may become most irregular and mental strain more intense.

In regard to diet, are we not apt to be too fussy with our five ounces of this and seven ounces of that ? Is not the diet that is given apt to be too pappy, to contain too many " slops " ? It came as a shock to be told by Meulengracht (1935) that he treated his cases of hæmatemesis and melæna, not with the traditional starvation, but with food of which the patients could have " as much as they want." The food which he allowed them to have included such things as " sliced meats, cheese, meat balls, broiled chops, omelette and fishballs." Revolutionary though this treatment may have appeared, he was, nevertheless, able to produce statistics to show that in a large series of patients the mortality was only about 1 per cent, a figure far lower than that published by any other authority. Further, when the patient is discharged from hospital, it does not seem to be of much practical use to give the soldier-patient (or any other patient for that matter) a long list of forbidden foods. He is quite sure to lose the list or forget which articles of food are forbidden, and in any case he is unlikely to obey any instructions if they are too complicated. It is better to explain that

he should " go short " on meats, meat soups and meat extractives, as these especially stimulate the secretion of acid in the stomach ; and forgo the doubtful satisfaction in being correct in mentioning every conceivable article of food or drink which might possibly have a deleterious effect on his gut.

It is worth exaggerating, if this is possible, the evil effects of smoking, if thereby he can be permanently impressed with the necessity of reducing his smoking to the bare minimum.

It is a probable waste of time to tell a patient " not to worry so much," but at least he can be told the connexion between his worrying (conscientious) habits and his symptoms, and warned that periods of mental stress and worry should for him be regarded as the danger times when he must be particularly careful to carry out the scheme of treatment most conscientiously.

SUMMARY.

(1) It is suggested that the treatment of duodenal ulcer is often too mechanical and ritualistic, and appears often to end when the patient is discharged from hospital.

(2) A plea is made for a closer personal interest in the patient, abolition of the printed list of forbidden foods, simple explanation to the patient regarding his condition, and above all ensurance of continuation of treatment after he has left hospital by instituting a régime sufficiently simple to be understandable and practical.

I am indebted to Colonel J. T. Simson, A.D.M.S. China Command, for permission to forward this article for publication.

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Echoes of the Past.

TWENTY YEARS AFTER.

BY H. SKIPTON STACY, M.D., Ch.M.(Syd.), F.R.A.C.S.
Honorary Consulting Surgeon at Sydney Hospital, Ryde Hospital, and Royal South Sydney Hospital.

(*Continued from page* 323.)

CASE 43.—Laceration of Brain.

Clinical History.—Nature of wound : Gunshot wound, head. (Bullet.)

Signs and symptoms : Brought in unconscious with a bullet wound of the head in the posterior portion of the parietal region to left of middle line ; having frequent convulsions, apparently starting with flexion of fingers of the right hand, followed by flexion of the elbow, gradually extending

to the head, and becoming general. Pulse 84. Reflexes: Knee-jerks and plantar absent on both sides. Next day he was even more deeply comatose. Pulse 57. Eyes: Right pupil very dilated and fixed; left, contracted and fixed. Still having slight convulsions, most marked in the right hand and arm. Left side of body neither rigid nor flaccid.

X-ray report: Antero-posterior: Nil. (Too restless for proper length of exposure.) Lateral. (Patient lying on left side.) Bullet magnified: is in the brain just beneath the vault of the skull.

Operation: Scalp wound excised; the punctured fracture in the skull was enlarged; out of this was coming lacerated brain substance. After enlargment the brain pulsated well. Bullet searched for along the track; although it could be felt it could not be grasped. Died about five hours later.

Survival: About thirty-six hours.

Post-mortem Result.—Head: Subarachnoid hæmorrhage over both hemispheres, slight in extent. Laceration of the left cerebral hemisphere in posterior portion of parietal lobe near the mid-line; this extended downwards and medially through the falx cerebri into the base of the right temporo-sphenoidal lobe which was much lacerated; in this the bullet lay. It missed the ventricles on both sides, also the corpus striatum and the optic thalamus. Much hæmorrhage into the right middle fossa; this evidently accounted for the paralysis of the right pupil. How did the bullet come to be near the vault in the radiograph? Was it pushed before the examining finger?

Comments: Nothing could have saved him.

CASE 44.—Laceration of Brain.

Clinical History.—Nature of wound: Gunshot wound, head. (? Trench-mortar.)

Signs and symptoms: Is unconscious; has incised wound of scalp on the left side of the head just behind and above the left ear. Pulse 40, temperature 97° F. Reflexes: Absent. Pupils equal and react to light. Blood from the nostrils; some effused blood in the left upper eyelid. Ears, normal. On the evening of operation pulse rose to 76, temperature to normal. Next day pulse 116, temperature 102° F., still deeply unconscious, has never had any convulsions. No paralysis apparent. Moves all his limbs. Next day temperature 104° F., pulse 160; breathing stertorous. Died.

Operation: Depressed fracture of the left temporal bone found; decompression done in this region; under the dura mater could be seen dark blood clot; the opening in was enlarged, an amount of blood clot and lacerated brain tissue escaped. Other wounds on the shoulder, etc., attended to.

Survival: About fifty-six hours.

Post-mortem Result.—Head: Effused blood over the parietal region of scalp. (Intra-muscular and sub-aponeurotic.) Fracture of skull in the temporal region just behind and above the left ear extending forwards to the right

frontal sinus. There was blood in both frontal sinuses and underneath the left orbital plate of the frontal bone. The posterior portion of the fracture was depressed, and had been removed at operation. The linear fracture also extended down to the posterior fossa just behind the petrous bone ; it also extended across the other side just behind the right petrous bone. The posterior portion of the left temporo-sphenoidal lobe was much lacerated. A good deal of subarachnoid hæmorrhage over the surfaces of both hemispheres, the right particularly. Other parts of the brain were apparently normal.

CASE 45.—Laceration of the Brain and Wound of Splenic Flexure of Colon.

Clinical History.—Nature of wound : Gunshot wound, head and abdomen.

Signs and symptoms : Wounded during a raid last evening ; semi-conscious, shocked and pale. Abdomen rigid ; liver dullness partly gone. Wound in the left tenth interspace in the posterior axillary line penetrating the abdomen, but apparently missing the pleura.

Operation : Abdomen opened to the left of mid-line ; offensive smell and some free dark blood in the left loin particularly ; splenic flexure much contused, actual rent not seen. (Difficult to get a good view.) Tube introduced into peritoneal cavity through the wound, and gauze packed down from the incision, which was T-shaped. He also had a wound in the middle of the forehead from which some lacerated brain was exuding ; nothing was done for this.

Survival : About sixteen hours.

Post-mortem Result.—Head : Punctured wound of the frontal bone just to the right of the mid-line ; this was found to extend through the dura to enter the apex of the frontal lobe, and to make a track right through the brain—laterally to the right lateral ventricle—coming out an inch or so anterior and lateral to the occipital pole. The track was laid open ; the brain found to be lacerated, and hæmorrhagic throughout its whole length. A small piece of shrapnel found lying above the tentorium. Diffuse subarachnoid hæmorrhage over the posterior half of both cerebral hemispheres.

Abdomen : Splenic flexure shows a through and through perforation and contusion of the wall of the bowel in the vicinity.

CASE 50.—Laceration of Brain with Extensive Hæmorrhage.

Clinical History.—Nature of wound : Gunshot wound, skull.

Signs and symptoms : Unconscious ; bleeding from the mouth. No paralysis or rigidity. Pulse 52, temperature sub-normal.

Survival : Six to eight hours.

Post-mortem Result.—Head : Wound just above occipital protuberance. and another in the frontal region just to the right of the mid-line ; punctured wound of occipital bone, punctured and extensive linear fractures of the frontal bone extending to the right temporal and into the right frontal sinus. Some subdural hæmorrhage, also subarachnoid. There was a track

through the right hemisphere from the occipital to the frontal lobe, at its deepest one-and-a-half inches; lateral ventricle not involved.

CASE 51.—Wound of Temporo-Sphenoidal Lobe with Septic Meningitis.

Clinical History.—Nature of wound: Gunshot wound, head.

Signs and symptoms: Sent in as a wound of the left ear only, but examination under the anæsthetic showed more extensive injury. The day after operation he was slightly drowsy; temperature normal, pulse 70. During the next two days he was more drowsy and somewhat irritable. Temperature normal. The following day the head was somewhat retracted; had twitching of the right side of the face; temperature 100° F.; eyes, mostly turned to the right, pupils unequal. Next day the convulsions became general, commencing on the right side of the face. Lumbar puncture was performed; the fluid was clear and under no pressure. He was unconscious for the last few days of life.

Operation: Examined under an anæsthetic and found to have, in addition to the wound of the left ear, a depressed fracture of the squamous portion of the left temporal bone just above the mastoid; the depressed portion was removed; the wound stitched up. Three days before death was operated on again; a limited decompression operation was done higher up in the temporal region; no improvement followed this.

Survival: Six days.

Post-mortem Result.—Head: The site of the original wound was at the junction of the petrous and squamous temporal; here was a small opening corresponding to the portion of bone that was removed. (The blow appears to have been a glancing one, not penetrating.) At this spot the dura was torn in linear fashion; underneath this was a hole in the temporo-sphenoidal lobe, presumably caused by the trauma; no foreign body (either missile or bone) could be felt in this. Extending up to the surface of the brain toward the middle line from this (especially over the motor area) was pus, both external and internal, to the arachnoid. The cerebral veins were much congested. The base of the brain appeared normal. The pus on the outer surface of the arachnoid was thick; presumably there were fine adhesions between the temporo-sphenoidal lobe and the base of the skull; whether there were or not, the sepsis did not appear to spread that way. The absence of pus in the cerebrospinal fluid on lumbar puncture was evidently accounted for by either the consistency of the pus and its small amount or by the adhesions.

CASE 58.—Laceration of Brain and Septic Meningitis.

Clinical History.—Nature of wound: Gunshot wound, head.

Signs and symptoms: Has a through and through wound of the skull; the missile entered the left side of the neck about one-and-a-half inches below the left ear, coming out behind the right ear. Is unconscious. During the eight days or so that he lived he was very irritable, keeping his head

under the bedclothes most of the time and resenting being disturbed, but he was conscious and would speak to his friends, call for the urinal and took his meals. Temperature for awhile was normal, and the pulse between 60 and 70. Then the temperature rose to 103° F., and the pulse to 140. Developed a hernia cerebri under the wound, following which he died in twenty-four hours.

Operation: Trephined over the exit wound; opening in the skull enlarged; some lacerated brain escaped.

Survival: About eight days.

Post-mortem Result.—Head: Entrance wound in the neck quite healed: this led to a punctured fracture in the left posterior fossa; here the missile passed through the left lobe of the cerebellum, then through the right lobe (not so deeply), then through the right cerebral hemisphere just in front of the occipital pole, coming out through the right temporal bone; from this there was a fissured fracture extending forward into the orbital plate of the frontal bone; the orbital plate was also fractured on the left side. (These fractures accounted for the hæmorrhage in both upper eyelids.) The membranes of the brain were intensely inflamed. There was dark blood clot in the right middle and posterior fossæ.

Comments: It seems remarkable that he should have lived so long.

CASE 59.—Subdural Hæmorrhage and Abscess of the Brain.

Clinical History.—Nature of wounds: Gunshot wound, skull.

Signs and symptoms: The wound of the skull appeared to be a glancing one; some lacerated brain substance protruding through the scalp wound. Rigidity of the right leg and arm. Knee-jerks normal and equal on both sides; right plantar reflex extensor. Pulse 60 on admission, but in a few hours rose to 140. Died several hours after operation.

Operation: Operated on about ten hours after admission. Wound excised and the skull opening enlarged; a detached piece the size of half-a-crown was removed; also several smaller pieces embedded in the lacerated brain. The brain was palpated around inside the cranium, causing more brain substance to escape. The patient's respiration became more rapid before the conclusion of the operation and he died shortly after.

Survival: About seventeen hours.

Post-mortem Result.—Head: Depression over the left motor area due to the loss of brain substance; subdural hæmorrhage over the leg area and over the posterior portion of the cerebral hemisphere. In the depth of the wound of the brain—but not communicating with the lateral ventricle—was a small cavity the size of an almond, the walls of which were distinctly purulent.

Pathological report: The pus from the cavity contained short Gram-positive bacilli.

Comment: The rising pulse was a bad omen; he would have died if not operated on, owing to the cerebral abscess: this developed very rapidly.

Comments made in 1937 after Reviewing the Notes.

In view of the great advance that localization of, and surgical attack on, cerebral lesions has made since 1917, it seems as if the heavy mortality of those days may be reduced in any future campaign. But of this we must not be too optimistic, since—as these notes show—death in the head cases was in most cases due to the inherently destructive nature of the wounds. As regards infection, I think the more accurate localization methods of to-day (which at the Front must necessarily include portable X-rays) will aid in the removal of a larger proportion of foreign bodies, and in that way reduce the incidence of infection. To what extent drugs such as Prontosil, etc., will help, still remains to be seen; there seems to be some hope in that direction.

Shock is still the great enemy.

Laceration of the brain is the most frequent finding. If the patient survives the sub-normal temperature and pulse may gradually rise, perhaps to 103° F. and 160 in a few days; then death will take place.

Through and through wounds of the skull and brain (causing extensive subdural and subarachnoid hæmorrhage, with a track through the brain usually lacerated and hæmorrhagic) did not live long. The pulse is not always fast: in Case 50 it was only 52.

Convulsions.—Convulsive movements and paralysis of limbs may be due to a subdural hæmorrhage, either with or without underlying laceration of the brain. There were many cases in which convulsions were absent; in these cases the motor areas were not involved. For example—

Case 58, who had a wound through both cerebellar lobes and of the right cerebral hemisphere just anterior to the occipital pole. Curiously enough he was conscious most of the time.

Case 44, who had much laceration of the left temporo-sphenoidal lobe and extensive subarachnoid hæmorrhage.

Turning to those cases which had convulsions there is Case 41, which had laceration of the brain about the vertex, slightly in front of the motor areas on the right side. His convulsions were general but particularly affected the left arm. The greater involvement of the left arm was fairly consistent with what was found; perhaps the left leg would have been even more likely to have been most involved.

In Case 51 there was a wound of the left temporo-sphenoidal lobe; pus extended up over the left motor area from this. About the fourth day he had twitching of the right side of the face; later convulsions became general and he died on the sixth day.

The convulsions were due to the septic meningitis rather than the location of the wound.

In Case 20 the post-mortem notes record twitching of the side of the body unaffected by the cerebral laceration.

On reviewing the case, it seems practically certain that this was due to meningitis which had become general.

under the bedclothes most of the time and resenting being disturbed, but he was conscious and would speak to his friends, call for the urinal and took his meals. Temperature for awhile was normal, and the pulse between 60 and 70. Then the temperature rose to 103° F., and the pulse to 140. Developed a hernia cerebri under the wound, following which he died in twenty-four hours.

Operation: Trephined over the exit wound; opening in the skull enlarged; some lacerated brain escaped.

Survival: About eight days.

Post-mortem Result.—Head: Entrance wound in the neck quite healed; this led to a punctured fracture in the left posterior fossa; here the missile passed through the left lobe of the cerebellum, then through the right lobe (not so deeply), then through the right cerebral hemisphere just in front of the occipital pole, coming out through the right temporal bone; from this there was a fissured fracture extending forward into the orbital plate of the frontal bone; the orbital plate was also fractured on the left side. (These fractures accounted for the hæmorrhage in both upper eyelids.) The membranes of the brain were intensely inflamed. There was dark blood clot in the right middle and posterior fossæ.

Comments: It seems remarkable that he should have lived so long.

CASE 59.—Subdural Hæmorrhage and Abscess of the Brain.

Clinical History.—Nature of wounds: Gunshot wound, skull.

Signs and symptoms: The wound of the skull appeared to be a glancing one; some lacerated brain substance protruding through the scalp wound. Rigidity of the right leg and arm. Knee-jerks normal and equal on both sides; right plantar reflex extensor. Pulse 60 on admission, but in a few hours rose to 140. Died several hours after operation.

Operation: Operated on about ten hours after admission. Wound excised and the skull opening enlarged; a detached piece the size of half-a-crown was removed; also several smaller pieces embedded in the lacerated brain. The brain was palpated around inside the cranium, causing more brain substance to escape. The patient's respiration became more rapid before the conclusion of the operation and he died shortly after.

Survival: About seventeen hours.

Post-mortem Result.—Head: Depression over the left motor area due to the loss of brain substance; subdural hæmorrhage over the leg area and over the posterior portion of the cerebral hemisphere. In the depth of the wound of the brain—but not communicating with the lateral ventricle—was a small cavity the size of an almond, the walls of which were distinctly purulent.

Pathological report: The pus from the cavity contained short Gram-positive bacilli.

Comment: The rising pulse was a bad omen; he would have died if not operated on, owing to the cerebral abscess: this developed very rapidly.

Comments made in 1937 after Reviewing the Notes.

In view of the great advance that localization of, and surgical attack on, cerebral lesions has made since 1917, it seems as if the heavy mortality of those days may be reduced in any future campaign. But of this we must not be too optimistic, since—as these notes show—death in the head cases was in most cases due to the inherently destructive nature of the wounds. As regards infection, I think the more accurate localization methods of to-day (which at the Front must necessarily include portable X-rays) will aid in the removal of a larger proportion of foreign bodies, and in that way reduce the incidence of infection. To what extent drugs such as Prontosil, etc., will help, still remains to be seen ; there seems to be some hope in that direction.

Shock is still the great enemy.

Laceration of the brain is the most frequent finding. If the patient survives the sub-normal temperature and pulse may gradually rise, perhaps to 103° F. and 160 in a few days ; then death will take place.

Through and through wounds of the skull and brain (causing extensive subdural and subarachnoid hæmorrhage, with a track through the brain usually lacerated and hæmorrhagic) did not live long. The pulse is not always fast : in Case 50 it was only 52.

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The convulsions were due to the septic meningitis rather than the location of the wound.

In Case 20 the post-mortem notes record twitching of the side of the body unaffected by the cerebral laceration.

On reviewing the case, it seems practically certain that this was due to meningitis which had become general.

In Case 9 the post-mortem revealed laceration of the right temporo-sphenoidal lobe, with the shrapnel lying alongside the pons.

Convulsions were most marked in the right side of the lip and in the left hand.

In Case 43 there was laceration of the left parietal lobe in its posterior portion, also laceration of the right temporo-sphenoidal lobe.

The convulsions started in the right hand and became general. Throughout the convulsions were most marked in the right hand and the right arm.

Reflexes.—In Cases 9, 43 and 44 the corresponding reflexes were absent. In all three the right or left temporo-sphenoidal lobe was lacerated, but I don't know that this had any significance.

Cases 59, 20, and 11 showed that in a lesion of the motor area, the corresponding knee-jerk is usually absent or nearly so; occasionally the plantar reflex is extensor. The knee-jerk may become evident later.

Rigidity and Flaccidity.—Wilfred Trotter, in Choyce's "Surgery," when discussing intracranial hæmorrhage, says that as hemiplegia comes on, rigidity passes off, and the limbs become flaccid. By the time the hemiplegia is established the limbs on the other side (i.e. on the side of the lesion) have become rigid.

The symptoms of intracranial hæmorrhage are divisible into irritative and paralytic; the irritative corresponding with the presence of venous congestion or stasis in the affected part of the brain, and the paralytic with the presence of anæmia.

We see this frequently borne out in civilian head injuries, e.g. the flaccidity we find in the paralysed limbs of a middle meningeal hæmorrhage: due to the anæmia of the cerebral cortex from the pressure of the extradural hæmorrhage.

The subdural lesion is usually accompanied by rigidity due to venous congestion of the cerebral cortex.

In Case 59 there was a laceration of the left motor area. The right leg and right arm were rigid. It was an early observation, as the patient died seventeen hours after admission.

In Case 32 there was a laceration of the right occipital lobe, also of the upper surface of the right lobe of the cerebellum, and a diffuse subarachnoid hæmorrhage. The legs were spastic and the arms were flaccid. This was also an early observation, as the patient died seven hours after admission.

In Case 28 there was contusion about the junction of the right temporo-sphenoidal and occipital lobe; also a laceration of the pons about the junction with the crura; also marked subarachnoid hæmorrhage. Both legs were rigid and both arms were flaccid. Also an early observation, as he died ten hours after admission.

In Case 15 there was a track leading through the right frontal lobe and through the left temporo-sphenoidal lobe; some blood in the left lateral ventricle; also diffuse subdural hæmorrhage (cortical and basal).

All limbs were spastic, especially those of the left side; he was paralysed on the left side.

In Case 11 there was laceration of the right parietal region; hernia cerebri; septic meningitis and encephalitis. On admission his left arm and leg were paralyzed; there was no rigidity. About the fourth day there was some rigidity of the left arm. Though the paralysis persisted in the limbs the rigidity later disappeared. He died on the eighteenth day.

In Case 9 there was laceration of the right temporo-sphenoidal lobe and subdural hæmorrhage over the middle portion of the right cerebral hemisphere. His left arm and left leg were flaccid and paralysed. An early observation, as he died in thirty hours.

I made a comment in 1917 to the effect that "spastic cases" mostly seemed to die. It may be that, in these cases, the rigidity is an indication of extensive destruction of the cortical cells of the motor or cerebrospinal tracts.

Blood in the Lateral Ventricle.—Trotter says that generalized convulsion may indicate very rapidly increasing pressure, such as that due to ventricular extension of a hæmorrhage, but it was not a feature of these cases. Of course, the ventricular hæmorrhage was usually but a small part of the lesion.

Case 41 had frequent convulsions; he survived only a few hours.

Cases 28, 25, and 15 had no convulsions.

Encephalitis and Septic Meningitis.—These in some cases have a tendency to be shut off by fine adhesions; hence the ill-effect of lumbar puncture and of operative manipulation in such cases. Septic meningitis was often accompanied by irritability as shown in Cases 58 and 51.

Cases 2, 58, 51 and 11 show the temperature in meningitis cases to be generally about 103° F. In Case 20 the temperature, pulse and respirations were all elevated.

Lumbar puncture was negative in Case 51. The head was retracted in this case, although at post-mortem the base of the brain appeared normal.

Twitching or convulsions were not uncommon in cases of meningitis; there was generally a latent period of several days.

Hernia Cerebri.—Case 58 showed that the patient only lived twenty-four hours after its development. Case 34 lived longer. Case 11 also developed hernia cerebri.

It is generally a bad sign; it favours sepsis which may not have been pre-existent. It is possible that some cases that died with it might have survived if it could have been prevented. Brain cases need keeping very quiet on their back for some time, to keep down the intracranial tension. Neglect of this, because the patient was making good progress, sometimes causes tragedies. It seems as if, in some cases, infection of the brain (encephalitis) predisposes to hernia cerebri (of course other conditions assisting), and, when present, makes sepsis worse—a vicious circle.

Abscess of the Brain.—Most of the cases in which this ended fatally died at the Base, but we had one which was visible in seventeen hours; however, he died from laceration of the brain rather than from the small abscess.

To prevent abscess formation it seems important to remove the foreign body if possible. Portions of bone driven in also seem to be the cause in

some cases. Palpation and instrumental examination sometimes push the foreign body further in. In view of the likelihood of infection, it is wiser to allow for drainage, not suture the wound too much.

In Case 34 neither the foreign body nor bone fragments were removed; it was preceded by hernia cerebri.

In Case 59 an electro-magnet was used, but without success.

Eyes—State of the Pupils.—Dilatation of the pupil seemed in some cases to be definitely due to blood in the middle fossa, but quite frequently the pupillary reactions were difficult to interpret.

Wounds of the cerebellum were very dangerous to life.

Temperature and Pulse.—When these were both elevated the outlook was grave. (We have a similar experience in civilian brain injuries.)

Impaired consciousness is not a certain diagnostic factor of a head injury but it is suspicious.

In Case 25 multiple wounds were excised without suspecting a co-existing brain injury; post-mortem showed an extensive laceration of the frontal lobe caused by an extremely minute piece of shrapnel which had entered through the orbit.

Ecchymosis of the upper eyelids in gunshot wounds of skull generally indicated a fracture of the orbital plate of the frontal bone.

Lumbar puncture was not done often, acting on the assumption that sudden withdrawal of cerebrospinal fluid might tend to break down localizing adhesions in a case that was possibly infected.

I think taking off a very small amount should not have this effect, and might prove of assistance to the diagnosis of meningitis.

In Case 51 the fluid was clear; the patient had cortical but not basal meningitis.

Size of the foreign body is not always commensurate with the damage it inflicts. Case 25 was one of extensive laceration of the frontal lobe, due to a very minute piece of shrapnel which had entered through the eye and then through the orbital plate. He was thought to have been suffering from severe prolonged shock, not from a cerebral lesion.

Hyperpyrexia.—In Case 28 (which only lived ten hours after admission). and which had a laceration of the pons (in addition to some contusion of the temporo-sphenoidal and occipital lobes) the temperature was 105·8° F., the pulse 158.

In Case 9 the shrapnel was found lying alongside the pons; the temperature was 104° F. (but there was also laceration in several other parts of the brain in this case).

Site of the Lesions.—Fronto-parietal lobe in Cases 59, 50, 41, 45, 43, 34, 25, 20, 15, 11 and 9.

Occipital lobe in Cases 4, 50, 45, 32, 28, 21.

Cerebellum in Cases 58, 32, 18.

Temporo-sphenoidal lobe in Cases 51, 44, 43, 28, 21, 15 and 9.

I have indicated the main sites of the lesions, but I do not know that any deductions can be drawn therefrom.

Although I have divided the brain roughly into lobes, it will be understood that in these cases there were generally other lesions, such as more or less extensive subdural and subarachnoid hæmorrhage.

In most cases they were either unconscious, or so extremely ill, that intelligent co-operation on the part of the patient in order to help in the localization of the injury was entirely out of the question.

Whether, in the future, the injection of thorotrast or some similar substance will help to localize the lesion or lesions is an interesting point.

It will noted that lesions of the fronto-parietal lobe easily outnumber the others.

Because of the prevalent idea that a lesion of the frontal lobe necessarily means some mental aberration, I have thought fit to interpolate some extracts from a recent paper by Geoffrey Jefferson in the *British Medical Journal* of July 31, 1937 : his article is on the " Removal of Right or Left Frontal Lobes in Man." It may not be altogether relevant, but it may help to throw some light on the after-prospects of some of these gunshot wounds of the brain, when we are able to save them. He records eight of his own cases in which surgical removal of one or other lobe on account of tumour was followed by an improvement in the previously altered mental condition. In the course of his article he says :—

" However, evidence drawn purely from traumatic material is apt to be fallacious, as we see in Phelps' assertion (1897) that mental changes nearly always follow an injury of the left frontal lobe, rarely one of the right. In more recent times, frontal lobe functions has been studied by many writers. Grainger Stewart, from his clinical observations, denied the dominance of the left frontal lobe, and stated that mental changes were much commoner with bilateral frontal, and especially callosal lesions than with those of one lobe alone. The present series confirms that view. Animal experiments have all pointed in one direction—that unilateral removal of areas corresponding to those removed in my own (Jefferson's) cases, led to no discoverable loss, whilst bilateral ablations did so."

One case only is on record in which both right and left frontal lobes have been excised in man—Brickner's case (1936). His character was quite altered.

Brickner, after exhaustive tests, concluded " that there was specific function in the frontal lobes which was not present in some degree elsewhere."

No one will deny that the frontal lobes are deeply concerned in intellectual processes and in emotional control, but they are not the only parts of the cerebral mass involved in these activities.

It can be concluded that the reason why we have not known the exact localization of the higher cerebral functions is because they are not localized to any one small area.

With reference to the fallacy of the greater importance of the left frontal lobe than the right, of course it must be conceded that once a lesion on the left side begins to go back behind the limit of the association area on the left, there is a likelihood of damage to the speech centres.

Gordon Holmes (1931) has expressed the opinion that mental symptoms are often due to high intracranial pressure, irrespective of the site of the lesion.

Bleeding from the mouth.—In Case 50 this must have come from the fracture of the frontal bone extending through the frontal sinus.

Several cases died of asphyxia from wounds of the buccal cavity : one (Case 40) under operation ; the other (Case 17) brought in dead. As the former case was given a general anæsthetic, the head should have been kept in a dependent position. (There were no suckers at the C.C.S.s) Some of these cases died on their way to the Clearing Station ; others, no doubt, on the Field. If it is recognized, then the case in transport should be kept in the head-low position.

Fracture of Cervical Spine and Injury to Cord.—As in civil life, if the lesion is above the origin of the phrenic nerve, it is not consistent with life for more than a few days.

(*To be continued.*)

Current Literature.

GREENWOOD, M., HILL, A. B., TOPLEY, W. W. C. and WILSON, JOYCE. **The Effect of Withdrawing Mice from an Infected Herd at Varying Intervals.** *J. Hygiene.* 1939, v. 39, 109–30, 1 fig.

It was previously found [Topley, *Journal of Hygiene*, 1922, v. 21, 20] that the division of a herd of mice, in which an epidemic due to *Bact. typhi-murium* was occurring, into small isolated groups was followed by a greatly decreased rate of mortality, provided the dispersal was carried out at the beginning of the epidemic period. If dispersal was delayed for a time [Topley and Wilson, *Bulletin of Hygiene*, 1926, v. 1, 273] the mortality in the isolated mice was much the same as in the mice remaining in the herd, at any rate for three weeks or so after isolation. The present paper describes a further experiment intended to throw light on the relation between the time of dispersal and the resulting mortality. An epidemic was started by introducing twenty-five mice infected with *Bact. typhi-murium* into a cage holding fifty normal mice. Three mice were added daily for a fortnight, till the epidemic was well under way, and then 60 mice were added at weekly intervals. Half the survivors of each batch of 60 mice were removed to single cages after seven days in the herd. The other half were left until they had been fourteen days in the herd, when half the survivors were removed to single cages. The same procedure was repeated with the remaining survivors after twenty-one days. Later, dispersal was not commenced till each batch of 60 mice had been in the cage for two, three, or four weeks, so as to provide mice for study with a greater cage age. Mice in single cages were regarded as specifically infected if *Bact. typhi-murium* was isolated from the fæces during life or from the tissues after death, or if agglutinins were present in the blood at the time of death. Determination of infection in

mice dying while still in the herd was made by isolation of *Bact. typhi-murium* from the tissues after death. The infection rates were rather lower than they might have been owing to the disturbing presence of *Ps. pyocyanea* in the spleens of many of the animals.

The rate of mortality in the herd rose nearly to its maximum level early in cage life—by the fourteenth to fifteenth day. The peak reached was considerably lower than that observed in previous experiments when small numbers of mice were added daily, instead of as in the present experiment when large numbers were added weekly. The peak rate of mortality was maintained, with but a slight fall, for at least seventy days, instead of falling rapidly as in previous experiments. Isolation was found to have a detrimental effect on the mortality of mice for the first few days of life in single cages (presumably owing to the dislike of mice for solitary confinement). Afterwards, however, the rate of mortality in the isolated mice was considerably lower than that of mice remaining in the herd. The maximum benefit of isolation appeared to be enjoyed by mice that had been in the main cage for only seven days, but the difference between these mice and those that had been in the main cage for as long as thirty-five days was very slight. On the whole, it is maintained that the earlier the withdrawal the greater is the benefit likely to be. It is pointed out that this conclusion refers only to animals in an open epidemic, i.e. an epidemic that is maintained by the continual addition of fresh susceptible animals. In a closed epidemic it is improbable that dispersal would have nearly such a favourable effect. Two further conclusions of interest are reached, namely (1) that mice which have survived for several weeks in an epidemic are not indifferent to the progress of that epidemic, and may succumb to specific infection after having resisted it successfully for a long time, and (2) that the rate of infection in a herd cannot be accounted for by any law based on a constant average risk of infection throughout herd life. This suggests, in combination with (1), that fluctuation in susceptibility to infection occurs from time to time in individual mice. G. S. WILSON.

Reprinted from " Bulletin of Hygiene," Vol. 14, No. 8.

VOLK, V. K., and BUNNEY, W. E. **Diphtheria Immunization with Fluid Toxoid and Alum Precipitated Toxoid. Preliminary Report.** *Amer. J. Pub. Health.* 1939, v. 29, 197–204.

The authors record a valuable study on the relative efficiency of various methods of immunizing children against diphtheria, as judged by antitoxin titrations at varying intervals after the immunizing injections. The total number of children studied was large (1,800); the age grouping is set out in detail for each procedure employed; and, in addition to comparisons between unselected groups of children immunized by different methods, there are records of trials in which alternate children in the same school were immunized by one of two methods under comparison.

The procedures compared were as follows :—

(1) One injection of formol toxoid.
(2) Two injections of formol toxoid, two weeks apart.
(3) Two injections of formol toxoid, three weeks apart.
(4) Three injections of formol toxoid, three weeks apart.
(5) One injection of alum precipitated toxoid.
(6) Two injections of alum precipitated toxoid, three weeks apart.

The results showed that a single injection of formol toxoid had a negligible immunizing effect. Four months after a single injection of this reagent 16·6 per cent of children had more than 0·001 A.U. of antitoxin per cubic centimetre of circulating blood, compared with 11·5 per cent of a control group of non-immunized children, while the corresponding figure for the groups immunized by procedures (2) to (5) varied from 64·4 to 100 per cent. The group of children immunized by two doses of formol toxoid two weeks apart was too small to admit of a valid comparison with other groups. Taking the other groups, in all of which the interval between successive doses, where these were given, was three weeks, and comparing the percentages of immunized children showing 0·001 A.U. or more, and 0·1 A.U. or more antitoxin per cubic centimetre of blood four months after immunization, the results were as follows :—

Reagent	Injections	0·001 A.U. or more %	0·1 A.U. or more %
F.T.	2	64·4	11·3
F.T.	3	98·1	25·3
A.P.T.	1	93·0	16·8
A.P.T.	2	100 0	54·0

No figures are available for the group immunized with two injections of A.P.T. after a longer interval than four months ; but the figures after twelve months, which are available for the other three groups, are in accord with the finding of other workers that the antitoxin titre falls more rapidly after a single injection of alum precipitated toxoid than after three injections of formol toxoid. W. W. C. Topley.

Reprinted from "Bulletin of Hygiene," Vol. 14, No. 8.

Reviews.

Aequanimitas, with Other Addresses to Medical Students, Nurses, and Practitioners of Medicine. By Sir William Osler, Bt., M.D., F.R.S. Reprinted from the Third Edition. London: H. K. Lewis and Co., Ltd. 1939. Price 7s. 6d.

That a book which was first published in 1904 should be re-edited and reprinted at intervals during a period of thirty-five years, affords ample evidence that the work has served more than the passing needs of its generation, and contains in it the seeds of immortality.

The reason for the popularity of these essays is not far to seek. " A rare and precious gift," says Osler, " is the Art of Detachment, by which a man may so separate himself from a life-long environment to take a panoramic view of the conditions under which he has lived and moved : it frees him from Plato's den long enough to see the realities as they are, the shadows as they appear." With this gift the author himself is richly endowed, and in the pages of this book are to be found his philosophical views on many aspects of the relationship of the doctor to the rest of the community, and of the art and science of medicine to life. Among others is an address on " The Army Surgeon," and although delivered in 1894 the advice which it offers to the young officer, pointing out the many special opportunities which will come his way, is as appropriate to-day as it was these many years ago. Other subjects which are reviewed in the kindly light of Osler's discerning mind are " Physic and Physicians as depicted in Plato," " The Leaven of Science," " British Medicine in Greater Britain," " Medicine in the 19th Century," " Chauvinism in Medicine." But perhaps the subjects themselves are of minor importance : the main interest lies in the genial and wise personality which reveals itself in discussing them.

This is not a book to be read from cover to cover and then cast aside. It is rather one to be placed conveniently to hand, so that it may be picked up in a leisure moment to convert an idle hour into one of profitable contemplation.

J. S. K. B.

HANDBOOK OF BACTERIOLOGY. By J. W. Bigger, M.D., Sc.D., F.R.C.P.I. Fifth Edition. Illustrated. London : Baillière, Tindall and Cox. 1939. Pp. xvi + 466. Price 12s. 6d.

A number of small books are published on bacteriology, and amongst those Bigger's " Handbook of Bacteriology " has an established place. It has now reached its fifth edition, which is evidence of the popularity and usefulness of this work.

A tendency with many of the small books dealing with this subject, as fresh editions appear, is to increase in size. In the case of the new edition of Bigger, however, this has to a great extent been avoided by less important matter being condensed or excluded. As a result the text occupies only twelve pages more than it did in the previous edition, and the work retains the essential features of a handbook.

In bringing the book thoroughly up to date, the author, as an experienced teacher of the subject, has incorporated all new work which has appeared to him to be sound and of sufficient importance to the student.

As in previous editions, success has been achieved by the subject matter being presented simply and clearly. Of the many chapters in the book, those on immunity call for special comment. To many students the subject of immunity appears involved, but in this work the author introduces this branch of the subject in such a way that the student has no difficulty in readily and rapidly grasping the essentials.

As an introduction to the subject of bacteriology this book can be recommended to both officer and laboratory assistant. It will be found useful for those revising their bacteriology for examinations.

ILLUSTRATIONS OF SURGICAL TREATMENT, INSTRUMENTS AND APPLIANCES. By Eric L. Farquharson, M.D., F.R.C.S.E. Edinburgh: E. and S. Livingstone. 1939. Pp. xii + 338. Price 20s. net.

In his foreword Professor Sir John Fraser states that the author has produced a " volume which in certain respects is unique." Without entering into detail he has " collected and described procedures which are of supreme importance to house surgeons and clinical assistants."

Certainly this book is exceptional, not so much because the author describes any new or novel method, but because his text is so freely and beautifully illustrated, and a good illustration is of extreme value when describing treatment of fractures and orthopædic conditions. The publishers deserve their full share of praise for the reproductions. Quite a third of the book is taken up by illustrations of instruments and appliances with descriptive notes. With reference to blood transfusion the Army favours a closed method in collecting the blood, but this attitude is dictated by considerations associated with work in the field. We have also adopted the Olivercrona thread saw, which is less likely to snap than the gigli. This volume can be confidently recommended to those who are specializing in surgical work. D. C. M.

FOOD, HEALTH AND VITAMINS. Eighth Edition. By R. H. A. Plimmer and Violet B. Plimmer. Longmans, Green and Co., Ltd. Price 5s.

The rapid advances made in our knowledge of food supplies and their relation to health, especially in regard to vitamins, have been responsible for necessitating eight editions of this book in the course of thirteen years, and the authors are deserving of our gratitude for keeping us up to date in this way.

The book within a comparatively small compass enlightens us as to the main features of food supplies from the scientific point of view, and is yet readable with pleasure and profit by the layman, scientific and technical terms having been reduced to a minimum.

The principal change in this latest edition is a fuller account of the necessities of the situation as regards the total quantities of food and the giving of a more detailed account of proteins and minerals.

The object of the authors, which is to explain concisely the principles which should guide the selection of food and to point out which foods should be eaten and why others should be avoided is most successfully achieved, and the book is very strongly recommended to members of the medical profession and others who are interested in the important subject with which it deals. A. E. R.

Infections of the Hand. By the late Lionel Fifield, F.R.C.S.Eng. Second Edition by Patrick Clarkson, F.R.C.S.Eng. (Guy's Hospital). London: H. K. Lewis and Co., Ltd. Illustrations 57 (including 8 plates). Pp. xii + 168. Price 9s.

Fifield's untimely death in 1928, two years after he brought out the first edition of this most useful little book, robbed the profession of a young surgeon of great promise.

Clarkson has improved the book by rewriting certain chapters, and in so doing has brought it up to date and improved it. It is not so common now to see cases where infections of the hand have been treated by a rapid and painful "nick" under ethyl chloride spray—thank Heaven!; but there is still need to impress on many that "the majority of severe infections of the hand have followed a trivial injury," and that "infection is generally the result of inadequate and faulty primary treatment."

When infection has become established it is a question of knowledge of the local anatomy, careful clinical observation, admission to hospital, and carefully planned operation deliberately carried out, under general anæsthesia, using a tourniquet, and avoiding pressure from drainage tubes.

In this book you will find the anatomy clearly described and illustrated, and the author's views on treatment will meet with general acceptance.

All surgeons in the Corps should know this book. There are a few grammatical inaccuracies, or phrases which might have been expressed differently. Page 26: "The superficial lymphatic vessels originate in a dorsal plexus which is most dense on the palm." "Extension to the sheath of a subcutaneous whitlow . . .", etc. D. C. M.

Treatment in General Practice. Volume III (Anæsthesia and Surgery). Articles republished from the *British Medical Journal*. London: H. K. Lewis and Co. Ltd. 1939. Pp. xi + 402. 60 illustrations. Price 10s. 6d.

Modern Treatment in General Practice. Year Book, 1939. Edited by Cecil P. G. Wakeley, F.R.C.S. London: Baillière, Tindall and Cox. Pp. xii + 365. Illustrated. Price 12s. 6d.

Here are two excellent publications, full of the most useful and interesting information, by various contributors. In both the printing is excellent and the key to the contents clear and concise.

In the volume containing reprints from the *British Medical Journal* the articles deal either with Anæsthesia or Surgery.

The Modern Treatment Year Book deals with mixed surgical and medical subjects, most of which will be of interest to officers of the Corps, and there is an intriguing section headed as usual, "Pitfalls," which deals with the differential diagnosis of swellings in various regions. The object of the author, to provide with the barest economy of words and with the greatest

clarity, authoritative statements on up-to-date teaching on diagnosis and treatment, has been splendidly carried out. Considering that so much ground is covered, it is strange what a little overlapping there is in these two volumes.

D. C. M.

Correspondence.

TREATMENT OF GAS BURNS OF THE EYE.

TO THE EDITOR OF THE "JOURNAL OF THE ROYAL ARMY MEDICAL CORPS."

DEAR SIR,—In view of the possibility of the Germans using gas it is necessary that every R.A.M.C. officer should know what to do with regard to eye burns. During the last war the great majority of such cases were not treated until the soldiers got beyond the casualty clearing stations. Mere lavage is not sufficient. Lavage with an alkaline lotion such as sod. bicarb. 5 grs. to the ounce or indeed simple saline solution helps to clear the conjunctival sac, but may I suggest that the following ointment be at once instilled for the first twenty-four hours ?

EYE OINTMENT FOR GAS POISONING.

Tube A.

℞	Sod. bicarb.		3 per cent
	Aqua dest. Adip. lan. anhydr. }	āā	10 ,,
	Paraffin molle alb.	ad.	100 ,,
Ft. ung.			Tube
Sig.	Alkaline eye salve for gas poisoning. First twenty-four hours.		

The second twenty-four hours the following :—

Tube B.

℞	Ung. ac. boracis	10 per cent
Sig.	Ophthalmic ointment. Tube. Second twenty-four hours.	

Indeed Tube B can be continued indefinitely. These tubes are made up by Messrs. Allen and Hanbury according to my instructions.

The patient pulls the lower lid down, lays a worm-like piece of the ointment along the lower fornix, then the patient looks down and closes his eye. Thus the upper lid imprisons the ointment. This method is much simpler than the use of a glass rod and the ointment is not squeezed out between the lids.

The eyes should be kept bandaged.

I give this prescription to all soldiers and officers wherever possible, and I would strongly recommend all medical men to do the same.

101 *Harley Street*,
London, *W*.1.
November 1, 1939.

I am, etc.,
R. LINDSAY REA.

Notices.

INFLUENZA VIRUS VACCINE.

We have received the following Memorandum from Messrs. Parkes, Davis & Co.:—

For immunization against the primary etiological agent of epidemic influenza, the Inoculation Department of St. Mary's Hospital, London, issue an Influenza Virus Vaccine. This consists of a formalinized suspension of several strains of the virus which have been isolated from cases of human influenza and shown by animal experiments to be the true virus of influenza. It has been shown that immunity to the virus remains at a high level for three months after inoculation with virus vaccine. In order to protect against the bacterial factors responsible for the serious complications, it is recommended that the virus vaccine should be used in conjunction with a bacterial vaccine such as Anti-Influenza Vaccine (Mixed) St. Mary's Hospital Formula. Since the immunity following Influenza Virus Vaccine takes about two weeks to reach its height, the vaccine should be administered some weeks before an epidemic is likely to occur.

RESUMPTION OF EXAMINATIONS.

The Royal Sanitary Institute and Sanitary Inspectors Examination Joint Board announce the resumption of examinations on a restricted scale, particulars of which will be supplied on application to the Institute or the Board at their address at 90, Buckingham Palace Road, Westminster, London, S.W.1.

"THE LANCET."

The Proprietors have agreed to offer *The Lancet* for the duration of the war at a guinea a year to doctors in H.M. Forces or working full time in the Emergency Medical Service.

INDEX TO VOLUME LXXIII.

C.N. = Clinical and other Notes.
C.L. = Current Literature.

EDITORIAL NOTICES.

The Editor will be glad to receive original communications upon professional subjects, travel, and personal experiences, etc.

Correspondence on matters of interest to the Corps, and articles of a non-scientific character, may be accepted for publication under a nom-de-plume.

All Communications or Articles accepted and published in the "Journal of the Royal Army Medical Corps" will (unless the Author notifies at the time of submission that he reserves the copyright of the Article to himself) become the property of the Library and Journal Committee, who will exercise full copyright powers concerning such Articles.

A free issue of twenty-five reprints will be made to contributors of Original Communications and of twenty-five excerpts in the case of Lectures, Travels, Clinical and other Notes, and Echoes of the Past.

Reprints or excerpts, additional to the above, can be furnished on payment if specially ordered at the time of submission of the article for publication.

Communications in regard to editorial business should be addressed—"The Editor, Journal of the Royal Army Medical Corps, A.M.D.5, Thames House, No. 3, Millbank, S.W. 1."

MANAGER'S NOTICES.

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